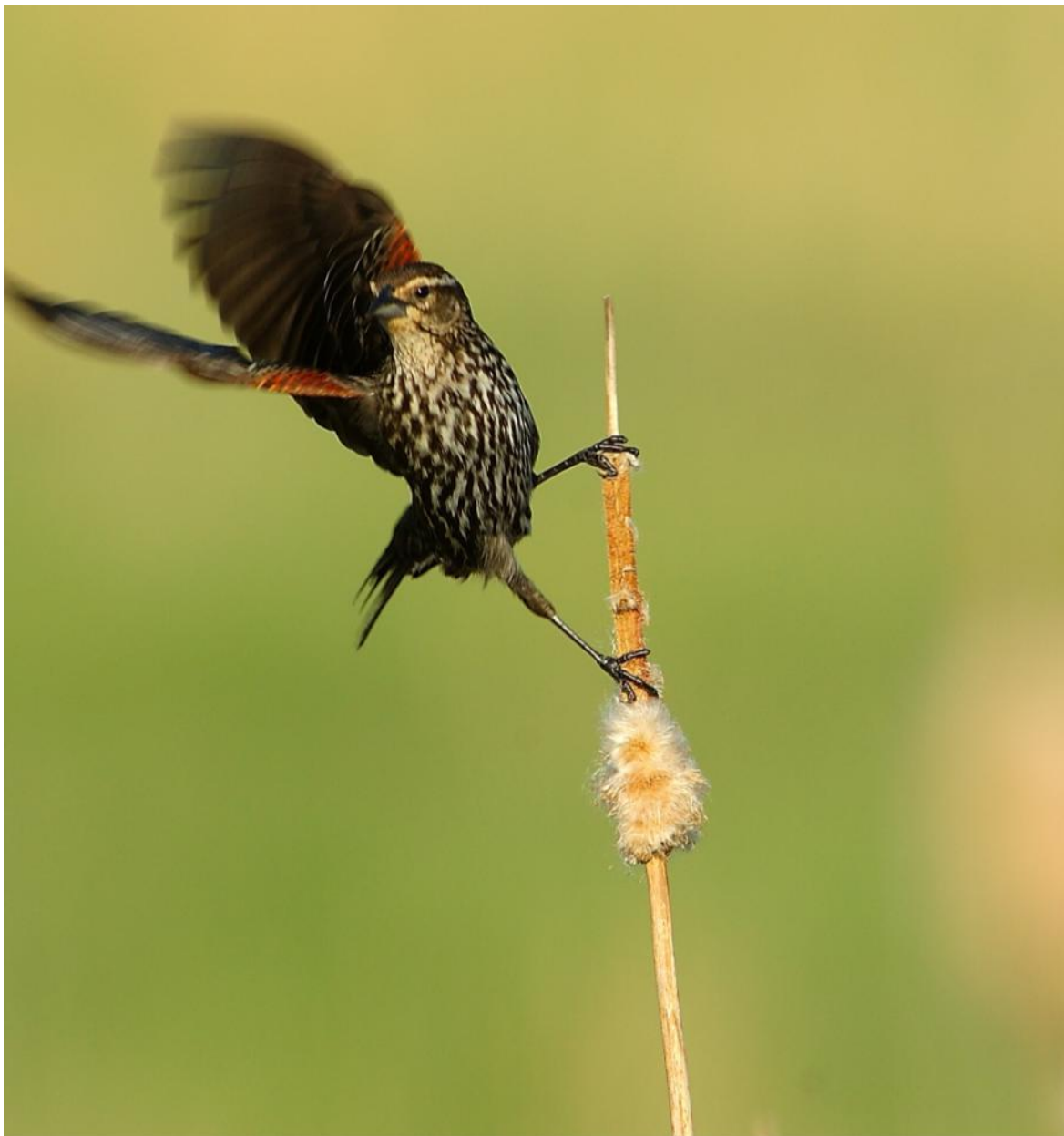




# Breeding Bird Monitoring

## *Mid-Atlantic Network 2011 Summary Report*

Natural Resource Data Series NPS/MIDN/NRDS—2012/331





**ON THE COVER**

Red-wing Blackbird (*Agelaius phoeniceus*)

Photograph by: Bill Moses



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## *Mid-Atlantic Network 2011 Summary Report*

Natural Resource Data Series NPS/MIDN/NRDS—2012/331

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U.S. Department of the Interior  
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Fort Collins, Colorado



The National Park Service, Natural Resource Stewardship and Science office in Fort Collins, Colorado publishes a range of reports that address natural resource topics of interest and applicability to a broad audience in the National Park Service and others in natural resource management, including scientists, conservation and environmental constituencies, and the public.

The Natural Resource Data Series is intended for the timely release of basic data sets and data summaries. Care has been taken to assure accuracy of raw data values, but a thorough analysis and interpretation of the data has not been completed. Consequently, the initial analyses of data in this report are provisional and subject to change.

All manuscripts in the series receive the appropriate level of peer review to ensure that the information is scientifically credible, technically accurate, appropriately written for the intended audience, and designed and published in a professional manner. This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

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## List of Acronyms

APCO: Appomattox Court House National Historical Park  
BCI: Bird Community Index  
BCR: Bird Conservation Region  
BOWA: Booker T. Washington National Monument  
FRSP: Fredericksburg and Spotsylvania National Military Park  
GRTS: Generalized Random Tessellation Stratified Design  
I&M: Inventory and Monitoring  
MIDN: Mid-Atlantic Network  
NABCI: North American Bird Conservation Initiative  
NB: National Battlefield  
NBP: National Battlefield Park  
NER: NPS Northeast Region  
NHP: National Historical Park  
NM: National Monument  
NMP: National Military Park  
NP: National Park  
NPS: National Park Service  
PETE: Petersburg National Battlefield  
PIF: Partners in Flight  
RICH: Richmond National Battlefield Park  
SE: Standard Error  
USGS: U.S. Geological Survey  
VAFO: Valley Forge National Historical Park



# Introduction

As part of the Natural Resource Challenge (NPS 1999), the Mid-Atlantic Network (MIDN) has been tasked with monitoring “vital signs,” a suite of physical, chemical, or biological elements or processes that represent the overall health or condition of the network parks’ natural resources. Breeding birds have been selected as one of the Mid-Atlantic Network’s vital signs because they are highly visible, are a reliable indicator of ecological integrity, and face numerous population threats in the region (Comiskey and Callahan 2008).

The Mid-Atlantic Network began pilot testing a volunteer breeding bird monitoring program in 2009 at three network parks and since then has expanded to six network parks (Figure 1). Four parks fall in the Piedmont Bird Conservation Region (BCR) and two fall just adjacent to the Piedmont BCR in the Southeastern Coastal Plain BCR. Developed by the North American Bird Conservation Initiative (NABCI), BCRs are ecologically distinct units designed to help focus conservation efforts for specific bird communities. The Mid-Atlantic Network consists of 10 park units across Pennsylvania and Virginia. In the future, the network hopes to expand monitoring efforts to the remaining parks within the network.

The two primary objectives for the monitoring protocol are to:

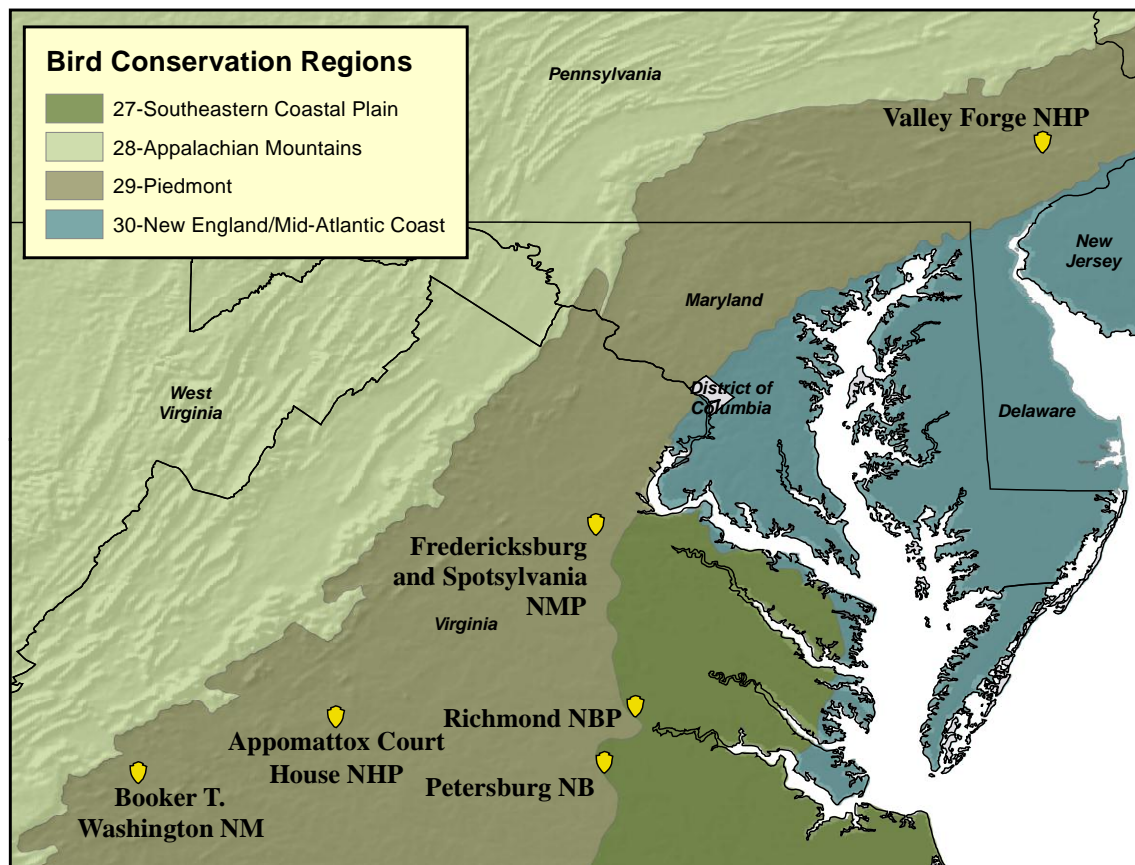
1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of the relationship between breeding birds, habitats, and park management.

This report summarizes monitoring data collected in 2009-2011. We provide park and region-wide abundance metrics for all species, and take note of the spatial distribution of species of conservation concern identified on a continental and regional scale (for the Piedmont/Southeastern Coastal Plain region). We also provide a community-wide assessment of species composition (a “Bird Community Index” or BCI) that informs on ecosystem integrity by evaluating the relative composition of different guilds in the overall bird community.

A resource brief that may be used as outreach material is also provided at the beginning of each park’s section of the report. Higher resolution versions of these documents that are suitable for printing may be downloaded from the Mid-Atlantic Network’s bird protocol website (<http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>).

Readers should treat results as provisional, as metrics may be confounded by variability in detection probability. A more comprehensive analysis that accounts for such variability will be included as we acquire more data.





**Figure 1.** Mid-Atlantic Network parks implementing bird monitoring in 2009-2011 and their associated Bird Conservation Region (BCR).



# Methods

## Study Area

Pilot testing for the bird monitoring program began in 2009 at Booker T. Washington National Monument (BOWA), Fredericksburg and Spotsylvania National Military Park (FRSP), and Valley Forge National Historical Park (VAFO). Since then, monitoring efforts have expanded to Appomattox Court House National Historical Park (APCO), Petersburg National Battlefield (PETE), and Richmond National Battlefield Park (RICH).

## Sample Design

Monitoring stations were selected by overlaying a 250 m grid on park maps. The grid is the same used for selecting vegetation monitoring plots (Comiskey et al. 2009), but offset by 125 m. This allows for point count stations to be co-located with vegetation monitoring plots, but reduces trampling or otherwise influencing vegetation monitoring data from repeat visits. Stations that were selected were within forest and grassland habitat types and were at least 15 m from hiking trails and secondary and tertiary roads (park roads), and 50 m from primary roads, park boundaries, and buildings which are frequented by visitors and may influence bird behavior.

BOWA is the smallest park in the network and has a good volunteer base, so all potential stations could be sampled. VAFO is a large contiguous park with more possible sampling locations than available volunteers. Therefore, stations at this park were randomly selected using the Generalized Random Tesselation Stratified (GRTS) algorithm (Stevens and Olsen 2004). APCO, like VAFO, is a large contiguous park, but due to severe limitations in available volunteers and the difficulty of accessing points in dense thickets, a GRTS sample was not possible. Therefore, only stations that were easily accessible were sampled at this park. FRSP, PETE, and RICH contain several discrete units separated over large areas. To maximize volunteer time, resource managers at those parks selected a unit most representative of their park or of management concern for monitoring (Table 2).

While the parks within the network are primarily forested, many also contain large areas managed as grasslands to represent historic battlefields. Resource managers were interested in long-term trends for both of these habitat types. Therefore, each point count station was categorized as either grassland or forest based on vegetation maps available for each park (Patterson 2008, Taverna and Patterson 2008, and Podniesinski et al. 2005). Edge buffers between habitat types were not applied because analysis is on the overall characterization of each habitat type rather than a comparison between types (Ralph et al. 1995).

## Surveys

Skilled volunteers with approximately 3-5 years of birding experience in the region were recruited by the parks. All volunteers attend a training session lead by the project lead prior to the field season. Point counts were conducted at stations between May 25 and July 15. Volunteers visited each station at least once per season. During each station survey, volunteers recorded all birds detected, including flyovers, in a ten-minute interval along with the minute the bird was first detected, whether the bird was within or beyond 50 m, the type of detection (visual, auditory, both), and the location of the detection. New species detected outside the formal count (i.e. walking between stations or detected right after count ended) were recorded as incidentals.



Data were transcribed to paper datasheets, entered into the U.S. Geological Survey (USGS) point-count database (<http://www.pwrc.usgs.gov/point/>), and later verified by the project lead.

## **Metrics**

We present total number of species, total detections, relative abundance, and percent occurrence summaries for the region and each park. In the past, we provided density estimates which incorporated variation in detectability relative to distance. These density estimates are not being presented in this report because we believe they will be more accurate and meaningful after additional data have accumulated and a thorough analysis of factors affecting detectability can be conducted. Because 75-100 detections per species are typically required for such analysis (Buckland et al. 2001), data will be fully analyzed and presented every 5-10 years. Hence, until such analyses are completed, results should be treated as preliminary since variation in detectability is not accounted for in the current data summaries.

## ***Number of Species***

All detections, including flyovers and incidentals, were included in species counts. Here, the goal is to document the total diversity of species across all six parks, so including incidental encounters is not problematic.

Special note was also taken for species of conservation concern. Partners in Flight (PIF), a cooperative effort to address the conservation of birds, produced a list of species of conservation concern in their North American Landbird Conservation Plan (Rich et al. 2004). They define two sets of species of concern, “Watchlist” species that face immediate threats due to habitat alteration, declining populations, small population size, and limited distributions, and “Stewardship” species that are representative species of avifaunal biomes that may or may not be in immediate danger. These lists have been developed at the continental and regional scale. We identified both continental and regional (e.g. Piedmont and Southeastern Coastal Plain BCRs) Watchlist and Stewardship species detected across the six parks.

## ***Detections***

Total raw detection counts included unknowns, flyovers and incidentals. Additionally, we summed detections across visits when presenting total raw detection counts, which may result in double-counted individuals. Total detection counts for individual species, however, did not include flyovers or incidentals and used maximum detection counts per species for each station if multiple visits were made.

## ***Relative Abundance***

Relative abundance was calculated by dividing the total detections by the number of monitoring stations surveyed. Because flyovers and incidentals are not strictly indicative of individuals using the survey area, they were removed from calculations of relative abundance. Additionally, in assessing the relative abundance of a particular species, using the sum of individuals across repeat visits may lead to upward-biased results (e.g. inflating abundance estimates by double-counting the same individual bird across multiple visits). To avoid this potential bias, we calculated relative abundance using the maximum count of detections per species across repeat visits (if applicable).



### ***Percent Occurrence***

Percent occurrence was calculated by dividing the total number of stations a species was detected in by the total number of stations surveyed. As with relative abundance, flyovers and incidentals were removed in calculations of percent occurrence, however, multiple visits to a site were not problematic as they provide a more complete picture of the bird community at the station location. Hence all visits were used to calculate percent occurrence.

### ***Avian Integrity Scorecards***

Avian guilds, or groups of species occupying similar ecological niches, are diverse and can be utilized for assessing response to environmental changes and ecosystem stressors. These guilds can be defined based on foraging behavior and substrate, nesting substrate, migratory distance, and various other life history traits. Changes in ecological condition can variably impact avian guilds, resulting in alterations to the bird community as a whole (Severinghaus 1981, Verner 1984). Bird community assessments, or “indices” (BCIs), yield a quantitative metric that can be used to define the ecological integrity of a sampled area based on the avian community present. BCIs assume that changes in habitat quality or extent, upon which a specific guild is dependent, result in corresponding changes in the representation of that guild within the overall bird community. Within the BCI, guilds are ranked based on specialization, with specialist guilds receiving higher weight over generalist guilds. This ability to use the bird community to reflect ecological condition, particularly in urban areas where impacts can be multi-faceted, provides a valuable and informative indicator for monitoring programs.

BCI scores and ratings are based on ecological criteria. However, due to cultural landscape objectives within the park and surrounding land use conditions, parks may not ever attain “high ecological integrity”. However, shifts in ecological integrity over time may be indicative of stressors. Additionally, a management scorecard could be developed by park and MIDN staff that would reflect progress towards avian and ecological management goals for individual parks.

BCIs are designed to represent major habitat types, as bird communities shift markedly by ecosystem. Two major habitat types dominate the parks in the Mid-Atlantic Network; forest and grassland. O’Connell et al. (2003) developed a combined forest integrity index for the Piedmont and Southeastern Coastal Plain ecoregions that can be applied to the points that fall in forested areas. For grassland bird communities, however, we are still exploring metrics for assessment.

### ***Avian Scorecard Methods***

For forest BCI analysis, data from grassland stations, incidentals, flyovers, and unknown species were removed. Only members of the following families were used in BCI analyses: Passeriformes, Columbiformes, Apodiformes, Piciformes, and Cuculiformes. Furthermore, only bird species that were included in the original development of these indices were considered (O’Connell et al. 2003, Coppedge et al. 2006).

If a station was visited more than once, detections for that station were aggregated. Forest integrity estimates based on O’Connell et al. (2003) are built from percent guild representation rather than counts of individuals, so multiple visits provide a more complete picture of the community and not an upward biased BCI score (e.g. from double-counted individuals).



Often, ecological integrity reports aggregate individual integrity metrics to create indices of overall ecosystem scores (Karr 1991, O'Connell et al. 2003). However, some believe that these indices may rely on a subjective understanding of the relative importance of each individual metric in estimating overall ecosystem integrity and that, by aggregating metrics, individual ecosystem components which may need attention are obscured (Faccio et al. 2010). Therefore, we summarized the data in both manners: across each individual guild and as an aggregated score.

### ***Calculating BCI scores***

All species detected at forested stations were assigned to appropriate guilds that were defined by O'Connell et al. (2003) and shown to respond most strongly to changing forest structure (Appendix A). Proportional guild representation was then calculated for each station. For example, if 2 of 10 species detected at a station were forest interior species, then that station had 20% forest interior species. That guild percentage was then assigned a rank score of 1, 2, 3, or 4 (Table 1) using thresholds derived by O'Connell et al. (2003) for the Piedmont and Southeastern Coastal Plain. This was done for each guild and a final BCI score for a station is then calculated as follows:

$$V1 = \frac{\sum \text{Structural Guild Ranks}}{4}$$

$$V2 = \frac{\sum \text{Functional Guild Ranks}}{4}$$

$$V3 = \frac{\sum \text{Compositional Guild Ranks}}{4}$$

$$BCI = \frac{V1 + V2 + V3}{9}$$

This final BCI score which ranges from 0.25 – 1.00 can then be then assigned a rank that falls on the Humanistic to Naturalistic scale of 1 to 4 (Table 1). Thus for each station, we derive individual guild rank scores and an aggregate rank score. Station aggregate scores are then averaged to provide scores for each park and the region.



**Table 1.** Rank scores by percent guild representation for forested sites based on O’Connell et al. (2003). See details on these guild assignments in Appendix A.

Guild		Percent Guild Representation			
		Rank = 1 Humanistic	Rank = 2 Moderately Disturbed	Rank = 3 Largely Intact	Rank = 4 Naturalistic
Structural Guilds	Forest Interior	0 -10.0	10.1 - 20.0	20.1 - 28.0	28.1 - 100
	Pine Associated	0	0.1 - 2.0	2.1 - 5.0	5.1 - 100
	Urban/Suburban	60.1 - 100	47.1 - 60.0	20.1 - 47.0	0 - 20.0
Functional Guilds	Bark Prober	0 - 9.0	9.1 - 16.0	16.1 - 20.0	20.1 - 100
	Upper Canopy Forager	0 - 4.0	4.1 - 12.0	12.1 - 18.0	18.1 - 100
	Ground Forager	0	0.1 - 3.0	3.1 - 7.0	7.1 - 100
Compositional Guilds	Single Brooded	0 - 16.0	16.1 - 34.0	34.1 - 46.0	46.1 - 100
	Nest Predator/Brood Parasite	23.1 -100	16.1 - 23.0	0.1 - 16.0	0
	Exotic	11.1-100	1.1 - 11.0	0.1 - 1.0	0
Final BCI Score		0.250-0.460	0.461-0.600	0.601-0.730	0.731-1.00



## Results and Discussion

### Region-wide

A total of 475 point counts were conducted by 37 volunteers at 239 stations in 2011 (Table 2). Of the stations, 162 were in forested habitat and 77 were in grassland habitat.

**Table 2.** Number of monitoring stations at six Mid-Atlantic Network parks in 2011 by habitat type, total number of surveys conducted, and total number of volunteers surveying.

Park	Park Unit	Park Code	Number of Stations			Total Surveys	Average Surveys/Station	Volunteers
			Forest	Grassland	Total			
Appomattox Court House National Historical Park (NHP)		APCO	16	6	22	22	1.00	4
Booker T. Washington National Monument (NM)		BOWA	12	4	16	56	3.50	6
Fredericksburg and Spotsylvania National Military Park (NMP)	Spotsylvania Battlefield	FRSP	51	8	59	77	1.31	7
Petersburg National Battlefield (NB)	Eastern Front	PETE	32	7	39	40	1.03	4
Richmond National Battlefield Park (NBP)	Malvern Hill	RICH	15	14	29	29	1.00	3
Valley Forge National Historical Park (NHP)		VAFO	36	38	74	251	3.39	13
<b>Total</b>			162	77	239	475	1.99	37

Across the six parks, 5,687 individual birds were detected encompassing 99 species, with an additional five species and 838 individuals detected as flyovers. Within forested habitats 89 species were detected, while 87 species were detected in grassland habitats. Valley Forge NHP had the greatest number of detections and number of species (Table 3), but it also had the greatest number of stations and surveys conducted (Table 2). Fredericksburg NMP had the highest number of species of concern.

**Table 3.** Total number of detections and number of species detected in 2011 at bird monitoring stations in six Mid-Atlantic Network parks.

Unit	Raw Detections*	Number of Species			Total
		Forest	Grassland	Species of Concern	
APCO	280	36	30	23	49
BOWA	805	43	43	24	54
FRSP	705	51	37	28	56
PETE	574	52	37	19	61
RICH	251	39	40	24	55
VAFO	3910	58	64	24	76

\*Raw detections are raw unadjusted counts including flyovers, incidentals, and possible double-counted individuals.



European Starlings had the highest relative abundance ( $\bar{x} = 1.25$  birds/station  $\pm 0.28$  SE) and the greatest number of detections ( $n = 299$ ) across the region. This species, however, typically occurs in large flocks and hence had highly variable counts and were only detected at 12.9% of stations. The Tufted Titmouse had the second highest relative abundance ( $\bar{x} = 0.87$  birds/station  $\pm 0.06$  SE), the second highest number of detections ( $n=209$ ), and was the most prevalent species in 2011 occurring at 60.3% of stations surveyed (Table 4).

A total of 37 species of concern as identified by Partners in Flight (PIF) were detected across the six parks, including 20 watchlist species and 17 stewardship species (Table 5). Two stewardship species, the Red-bellied Woodpecker and Carolina Wren, were among the 10 most abundant (Table 4). The Wood Thrush, a watchlist species was the 11<sup>th</sup> most abundant species.

The average BCI for forested stations across the parks was  $0.71 \pm 0.01$ , giving the region a rating of “largely intact” (Table 6). The pine associated guild had the lowest rating, ranked “moderately disturbed.” The remaining guilds were either rated as “largely intact” or “naturalistic.”



**Table 4.** Number of detections, mean and standard error of abundance (birds/station), and the number and percentage of stations individual species were detected at during the 2011 breeding bird monitoring season at six Mid-Atlantic Network parks. Detections do not include flyovers or incidentals and uses maximum detection counts per species for each station if multiple visits were made.

Species	Detections	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)
European Starling <sup>1</sup>	299	1.25 $\pm$ 0.28	12.97
Tufted Titmouse	209	0.87 $\pm$ 0.06	60.25
Blue Jay	205	0.86 $\pm$ 0.08	49.79
Red-eyed Vireo	181	0.76 $\pm$ 0.06	53.97
American Robin	159	0.67 $\pm$ 0.07	38.91
American Crow	142	0.59 $\pm$ 0.07	33.05
Northern Cardinal	131	0.55 $\pm$ 0.05	40.59
Red-winged Blackbird	128	0.54 $\pm$ 0.13	14.23
Red-bellied Woodpecker†	127	0.53 $\pm$ 0.04	42.26
Carolina Wren†	114	0.48 $\pm$ 0.04	38.49
Wood Thrush*	114	0.48 $\pm$ 0.05	33.47
Carolina Chickadee†	113	0.47 $\pm$ 0.05	35.15
Eastern Wood-Pewee*	112	0.47 $\pm$ 0.04	37.24
Ovenbird	95	0.40 $\pm$ 0.05	26.78
Indigo Bunting†	93	0.39 $\pm$ 0.05	27.2
Mourning Dove	81	0.34 $\pm$ 0.04	26.78
Song Sparrow	75	0.31 $\pm$ 0.05	17.99
Acadian Flycatcher†	73	0.31 $\pm$ 0.04	24.27
Chipping Sparrow	71	0.30 $\pm$ 0.05	20.5
White-breasted Nuthatch	71	0.30 $\pm$ 0.04	23.43
Scarlet Tanager	67	0.28 $\pm$ 0.04	23.43
Eastern Meadowlark*	65	0.27 $\pm$ 0.05	12.97
Northern Mockingbird	61	0.26 $\pm$ 0.04	17.57
Common Yellowthroat	60	0.25 $\pm$ 0.04	17.15
Canada Goose	59	0.25 $\pm$ 0.15	2.09
American Goldfinch	58	0.24 $\pm$ 0.04	17.99
Field Sparrow*	57	0.24 $\pm$ 0.04	14.23
Gray Catbird	51	0.21 $\pm$ 0.04	15.06
Pileated Woodpecker†	51	0.21 $\pm$ 0.03	18.83
Baltimore Oriole*	50	0.21 $\pm$ 0.04	16.32
Blue-gray Gnatcatcher	48	0.20 $\pm$ 0.03	17.15
Barn Swallow	45	0.19 $\pm$ 0.05	8.79
Downy Woodpecker†	45	0.19 $\pm$ 0.03	17.99
Great Crested Flycatcher	44	0.18 $\pm$ 0.03	15.9
Yellow-billed Cuckoo*	43	0.18 $\pm$ 0.03	16.74
Brown-headed Cowbird	42	0.18 $\pm$ 0.03	14.23
Eastern Kingbird*	41	0.17 $\pm$ 0.04	10.46
Eastern Towhee*	41	0.17 $\pm$ 0.03	13.81
Orchard Oriole†	40	0.17 $\pm$ 0.04	8.79



**Table 4.** Number of detections, mean and standard error of abundance (birds/station), and the number and percentage of stations individual species were detected at during the 2011 breeding bird monitoring season at six Mid-Atlantic Network parks (continued).

Species	Detections	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)
Eastern Bluebird	38	0.16 $\pm$ 0.03	11.72
Northern Flicker*	37	0.15 $\pm$ 0.03	14.23
Common Grackle	29	0.12 $\pm$ 0.04	7.53
Chimney Swift*	20	0.08 $\pm$ 0.04	2.93
Summer Tanager†	19	0.08 $\pm$ 0.02	6.69
Eastern Phoebe	18	0.08 $\pm$ 0.02	6.69
Tree Swallow	18	0.08 $\pm$ 0.02	4.6
Cedar Waxwing	16	0.07 $\pm$ 0.02	4.6
Turkey Vulture	16	0.07 $\pm$ 0.02	4.18
Pine Warbler†	14	0.06 $\pm$ 0.02	5.44
White-eyed Vireo†	13	0.05 $\pm$ 0.02	5.02
Yellow-throated Vireo†	13	0.05 $\pm$ 0.02	5.02
American Kestrel	10	0.04 $\pm$ 0.02	3.35
Hairy Woodpecker	10	0.04 $\pm$ 0.01	4.18
House Finch	10	0.04 $\pm$ 0.02	2.09
Prairie Warbler*	10	0.04 $\pm$ 0.02	3.35
Warbling Vireo	10	0.04 $\pm$ 0.01	4.18
Blue Grosbeak†	9	0.04 $\pm$ 0.01	3.35
House Wren	9	0.04 $\pm$ 0.01	3.77
Wood Duck	9	0.04 $\pm$ 0.04	0.42
Mallard	8	0.03 $\pm$ 0.02	0.84
Ruby-throated Hummingbird	8	0.03 $\pm$ 0.01	3.35
Willow Flycatcher*	8	0.03 $\pm$ 0.01	2.93
Yellow Warbler	8	0.03 $\pm$ 0.01	3.35
Brown Thrasher*	7	0.03 $\pm$ 0.01	2.51
Louisiana Waterthrush	7	0.03 $\pm$ 0.01	2.93
Northern Parula†	7	0.03 $\pm$ 0.01	2.93
Red-tailed Hawk	7	0.03 $\pm$ 0.01	2.09
Grasshopper Sparrow*	6	0.03 $\pm$ 0.02	1.26
Black Vulture	5	0.02 $\pm$ 0.01	1.67
Horned Lark	4	0.02 $\pm$ 0.01	0.84
Northern Bobwhite*	4	0.02 $\pm$ 0.01	1.67
Wild Turkey	4	0.02 $\pm$ 0.01	1.26
Kentucky Warbler*	3	0.01 $\pm$ 0.01	1.26
Northern Rough-winged Swallow	3	0.01 $\pm$ 0.01	0.84
Yellow-breasted Chat	3	0.01 $\pm$ 0.01	1.26
American Redstart	2	0.01 $\pm$ 0.01	0.84
Barred Owl	2	0.01 $\pm$ 0.01	0.84
Belted Kingfisher	2	0.01 $\pm$ 0.01	0.84
Black-billed Cuckoo*	2	0.01 $\pm$ 0.01	0.84



**Table 4.** Number of detections, mean and standard error of abundance (birds/station), and the number and percentage of stations individual species were detected at during the 2011 breeding bird monitoring season at six Mid-Atlantic Network parks (continued).

Species	Detections	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)
Bobolink	2	0.01 $\pm$ 0.01	0.84
Double-crested Cormorant	2	0.01 $\pm$ 0.01	0.42
Killdeer	2	0.01 $\pm$ 0.01	0.42
Red-headed Woodpecker*	2	0.01 $\pm$ 0.01	0.84
Red-shouldered Hawk†	2	0.01 $\pm$ 0.01	0.84
Worm-eating Warbler*	2	0.01 $\pm$ 0.01	0.84
Yellow-throated Warbler	2	0.01 $\pm$ 0.01	0.84
Black-and-white Warbler	1	0.00 $\pm$ 0.00	0.42
Blue-headed Vireo	1	0.00 $\pm$ 0.00	0.42
Brown Creeper	1	0.00 $\pm$ 0.00	0.42
Great Blue Heron	1	0.00 $\pm$ 0.00	0.42
Hooded Warbler†	1	0.00 $\pm$ 0.00	0.42
Least Flycatcher	1	0.00 $\pm$ 0.00	0.42
Nashville Warbler	1	0.00 $\pm$ 0.00	0.42
Palm Warbler	1	0.00 $\pm$ 0.00	0.42
Rose-breasted Grosbeak	1	0.00 $\pm$ 0.00	0.42
Swainson's Thrush	1	0.00 $\pm$ 0.00	0.42

\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, †Exotic species



**Table 5.** Bird species detected in the six Mid-Atlantic Network parks during the 2011 breeding bird monitoring season and patterns of occurrence between 2009-2011. Closed circles indicate species that were detected in a station while open circles indicate species that were only detected as flyovers or incidentals.

Species	APCO	BOWA	FRSP	PETE	RICH	VAFO	Region		
							2009	2010	2011
Canada Goose					○	●	●	●	●
Mute Swan						○			○
Wood Duck					○	●		●	●
Mallard						●	●	●	●
Common Peafowl							○		
Wild Turkey				●	●		●	●	●
Northern Bobwhite*					●			●	●
Double-crested Cormorant						●			●
Great Blue Heron		●	○	○	○	○	●	●	●
Green Heron						○		●	○
Black Vulture					●	●	●	●	●
Turkey Vulture	○		○	●	○	●	●	●	●
Osprey								●	
Bald Eagle								○	
Sharp-shinned Hawk								●	
Cooper's Hawk						○	○		○
Red-shouldered Hawk†		○	○	●	●		●	●	●
Broad-winged Hawk*						○			○
Red-tailed Hawk			●		●	●	●	●	●
American Kestrel						●	●	●	●
American Coot								●	
Killdeer				●			●	●	●
Lesser Yellowlegs								●	
Rock Pigeon <sup>1</sup>						○		○	○
Mourning Dove	●	●	●	●	●	●	●	●	●
Black-billed Cuckoo*						●		○	●
Yellow-billed Cuckoo*	●	●	●	●	●	●	●	●	●
Eastern Screech-Owl								●	
Barred Owl		●	●				●		●
Chimney Swift*	●	●	○	○	○	●	●	●	●
Ruby-throated Hummingbird	●	●	●	●				●	●
Belted Kingfisher	●			○		●	●	●	●
Red-headed Woodpecker*					●			●	●
Red-bellied Woodpecker†	●	●	●	●	●	●	●	●	●
Downy Woodpecker†	●	●	●	●	●	●	●	●	●
Hairy Woodpecker			●	●		●	●	●	●
Northern Flicker*			●	●		●	●	●	●
Pileated Woodpecker†	●	●	●	●	●	●	●	●	●



**Table 5.** Bird species detected in the six Mid-Atlantic Network parks during the 2011 breeding bird monitoring season and patterns of occurrence between 2009-2011 (continued).

Species	APCO	BOWA	FRSP	PETE	RICH	VAFO	Region		
							2009	2010	2011
Eastern Wood-Pewee*	●	●	●	●	●	●	●	●	●
Acadian Flycatcher†	●	●	●	●	●		●	●	●
Willow Flycatcher*			●	●		●	●	●	●
Least Flycatcher				●					●
Eastern Phoebe		●	●	●	●	●	●	●	●
Great Crested Flycatcher	●	●	●	●	●	●	●	●	●
Eastern Kingbird*	●	●				●	●	●	●
White-eyed Vireo†			●	●	●		●	●	●
Yellow-throated Vireo†	●	●	●	●	●		●	●	●
Blue-headed Vireo					●				●
Warbling Vireo						●	●	●	●
Red-eyed Vireo	●	●	●	●	●	●	●	●	●
Blue Jay	●	●	●	●	●	●	●	●	●
American Crow	●	●	●	●	●	●	●	●	●
Fish Crow			○					●	○
Horned Lark				●					●
Purple Martin†	○				○		○		○
Tree Swallow				●	○	●	●	●	●
Northern Rough-winged Swallow		●				●	○	●	●
Bank Swallow						○		●	○
Barn Swallow	●	●		●	○	●	●	●	●
Carolina Chickadee†	●	●	●	●	●	●	●	●	●
Tufted Titmouse	●	●	●	●	●	●	●	●	●
White-breasted Nuthatch	●	●	●	●		●	●	●	●
Brown Creeper			●						●
Carolina Wren†	●	●	●	●	●	●	●	●	●
House Wren						●	●	●	●
Blue-gray Gnatcatcher	●	●	●	●	●	●	●	●	●
Eastern Bluebird	●	●	○	●	●	●	●	●	●
Veery							●	●	
Swainson's Thrush				●					●
Wood Thrush*	●	●	●	●	●	●	●	●	●
American Robin	●	●	●	●	●	●	●	●	●
Gray Catbird				●		●	●	●	●
Northern Mockingbird	●	●		●	●	●	●	●	●
Brown Thrasher*	●	●	●			●	●	●	●
European Starling <sup>1</sup>	●	●		●		●	●	●	●
Cedar Waxwing		○		●		●	●	●	●
Blue-winged Warbler*							●	●	



**Table 5.** Bird species detected in the six Mid-Atlantic Network parks during the 2011 breeding bird monitoring season and patterns of occurrence between 2009-2011 (continued).

Species	APCO	BOWA	FRSP	PETE	RICH	VAFO	Region		
			2011				2009	2010	2011
Nashville Warbler				•					•
Northern Parula†	•	•	•		•	•	•	•	•
Yellow Warbler						•	•	•	•
Yellow-throated Warbler	•			•			•	•	•
Pine Warbler†	•	•	•	•	•		•	•	•
Prairie Warbler*		•	•		•	•	•	•	•
Palm Warbler				•				•	•
Blackpoll Warbler								•	
Black-and-white Warbler				•					•
American Redstart	•					•		•	•
Worm-eating Warbler*			•				•	•	•
Ovenbird	•	•	•	•	•	•	•	•	•
Louisiana Waterthrush		•	•	•		•	•	•	•
Kentucky Warbler*			•	•				•	•
Common Yellowthroat	•	•	•	•	•	•	•	•	•
Hooded Warbler†			•				•	•	•
Canada Warbler							•		
Yellow-breasted Chat			•		•		•	•	•
Summer Tanager†	•		•	•			•	•	•
Scarlet Tanager	•	•	•	•	•	•	•	•	•
Eastern Towhee*	•	•	•	•		•	•	•	•
Chipping Sparrow	•	•	•	•	•	•	•	•	•
Field Sparrow*	•	•	•		•	•	•	•	•
Grasshopper Sparrow*	•	•				•	•	•	•
Song Sparrow				•		•	•	•	•
Northern Cardinal	•	•	•	•	•	•	•	•	•
Rose-breasted Grosbeak						•			•
Blue Grosbeak†	•	•	•		•		•	•	•
Indigo Bunting†	•	•	•		•	•	•	•	•
Bobolink						•			•
Red-winged Blackbird		•			○	•	•	•	•
Eastern Meadowlark*	•	•			○	•	•	•	•
Common Grackle	•	•		•	○	•	•	•	•
Brown-headed Cowbird	•	•	•	•	○	•	•	•	•
Orchard Oriole†		•	•		•	•	•	•	•
Baltimore Oriole*						•	•	•	•
House Finch		•		•		•	•	•	•
American Goldfinch	•	•	•	•	○	•	•	•	•

\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, †Exotic species



**Table 6.** Regional avian forest guild summary and Bird Community Index (BCI) score for 2011. Percents indicate the average percent guild membership at monitoring locations across six parks in the Mid-Atlantic Network. Total BCI scores range from 0-1 with 1 being having the highest integrity. Ranks are derived from O'Connell et al. (2003).

	Guild	Percent	Rank
Structural	Forest Interior	32.34	Naturalistic
	Pine Associated	0.80	Moderately Disturbed
	Urban/Suburban	36.34	Largely Intact
Functional	Bark Prober	21.34	Naturalistic
	Ground Forager	5.69	Largely Intact
	Upper Canopy Forager	19.01	Naturalistic
Compositional	Nest Predator/Brood Parasite	13.99	Largely Intact
	Single Brooded	51.81	Naturalistic
	Exotic	0.24	Largely Intact
Total BCI Score		0.71	Largely Intact



# Appomattox Court House National Historical Park

Northeast Region  
Inventory & Monitoring Program

National Park Service  
U.S. Department of the Interior



## Mid-Atlantic Network

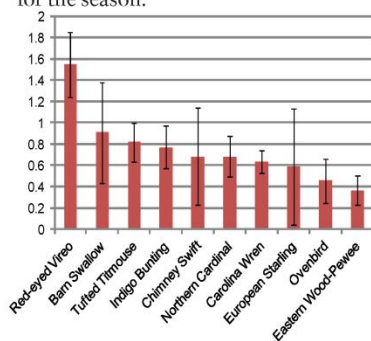
## Breeding Bird Resource Brief



Baltimore Oriole

### Appomattox Court House National Historical Park 2011 Status & Trends

A total of 22 stations were surveyed at Appomattox Court House NHP during the park's second season of breeding bird monitoring, including 16 stations in forested habitats and 6 stations in grassland habitats. Four volunteer birders from the local birding community conducted an average of 1.0 surveys per station producing a total of 22 surveys for the season.



The 10 most commonly detected bird species at Appomattox Court House NHP in 2011 and their associated relative abundance (average birds/station). Error bars indicate standard error, a measure of variation.

Between May and June, 280 birds of 49 species were detected throughout the park. Both forested and grassland habitats showed good species richness with 36 species in forested habitats and 30 in grassland habitats. Several species were detected this year that were not in previous years including the Purple Martin, Brown Thrasher, Summer Tanager, and Pileated Woodpecker.

Red-eyed Vireos had the highest relative abundance averaging 1.55 birds / station and were the most prevalent species, occurring in 72.7% of the stations surveyed.

Species of conservation concern, as defined by Partners in Flight (PIF), were well represented in the park, with volunteers detecting 23 species (see table on back right). PIF further distinguishes species of concern as "watchlist" species, which face immediate threats, or "stewardship" species, which are rep-

### Objectives

1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of relationships between breeding birds, habitats and park management.

resentative of avifaunal biomes that may or may not be in immediate danger.

Within the park, 10 watchlist species and 13 stewardship species were detected. Three species of concern including a watchlist species (i.e. Chimney Swift) and 2 stewardship species (i.e. Indigo Bunting and Carolina Wren) were among the 10 most abundant species.

Avian guilds, or groups of species occupying similar ecological niches, can be utilized for assessing response to environmental changes and ecosystem stressors via bird community assessments, or "indices" (BCIs). Based on a BCI developed for the Piedmont/Coastal



Tufted Titmouse

### Importance

In the densely populated Mid-Atlantic region, birds face numerous threats including urbanization, habitat loss, and fragmentation. National parks provide refuge from such threats with contiguous and protected tracts of habitat suitable for breeding birds. These parks host species of continental concern and other species that are declining throughout their range.

Birds are also excellent barometers of ecosystem health due to their high metabolism and prominent position in the food web. Detecting changes in bird populations may help alert park staff to ecological stressors such as invasive species, overbrowsing, detrimental park management practices, or climate change and help guide future management actions.

**Figure 2.** 2011 Resource Brief for Appomattox Court House NHP. A high resolution version may be downloaded from <http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>.



## Management Applications

- A total of 49 species were detected across the park including 23 species of concern.
- Three species of concern were among the 10 most common species in the park.
- Red-eyed Vireos had the highest abundance using unadjusted counts and were the most prevalent species in the park.

## Long-term Monitoring

Between May and July of each year, volunteer birders conduct point counts at monitoring stations in forest and grassland habitats. Stations in forested areas are located within 125 m of forest vegetation monitoring plots enabling park staff to associate long-term trends in vegetation with avian population trends.

During each 10-minute count, the volunteer records environmental

conditions, how the bird was detected (visually or aurally), and the distance and minute of first detection.

Each site is visited at least once, but volunteers are encouraged to make multiple visits in a season. Multiple visits are especially important for obtaining accurate density estimates as information on variability due to observers, weather, etc. can be accounted for.

## Status & Trends Continued...

Plain region (O'Connell et al. 2003), forested stations maintained their ecological rank of "naturalistic", the highest rank available in the metric. When broken out by guild, most ranks were of medium to high ecological integrity (see

table on left) and all but the pine associated guild improved or maintained their rank from 2010.

		2010		2011	
Guild		Percent	Rank	Percent	Rank
Structural	Forest Interior	22.77	Largely Intact	29.55	Naturalistic
	Pine Associated	2.92	Largely Intact	0.89	Moderately Disturbed
	Urban/Suburban	42.50	Largely Intact	37.04	Largely Intact
Functional	Bark Prober	16.42	Largely Intact	22.16	Naturalistic
	Ground Forager	2.49	Moderately Disturbed	5.55	Largely Intact
	Upper Canopy Forager	28.93	Naturalistic	24.55	Naturalistic
Compositional	Nest Predator/Brood Parasite	18.52	Moderately Disturbed	11.49	Largely Intact
	Single Brooded	46.02	Naturalistic	50.19	Naturalistic
	Exotic	0.00	Naturalistic	0.00	Naturalistic
Total BCI Score		0.78	Naturalistic	0.86	Naturalistic

Avian forest guild summary and Bird Community Index (BCI) score for 2010-2011. Percents indicate the average percent guild membership at monitoring locations across the park. Total BCI scores range from 0-1 with 1 having the highest integrity.

## A Final Note

It is important to note that the data presented in this brief is preliminary and results are limited to areas in the park sampled. For more information on this protocol, please see the full annual report accessible from the protocol website linked below.

We'd like to thank all our volunteers for walking off the beaten path in the summer heat to count birds: Thelma Dalmás, JoAnne Pierce, John Styrsky, and Gene Sattler.



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**Protocol Website:**  
More information and full annual reports may be found at  
<http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>

**Photographs by:**  
Jim Schmidt and Bill Thompson

Species	Detections	% Occupied
<b>Watchlist Species</b>		
Brown Thrasher	1	4.5
Chimney Swift	15	13.6
Eastern Kingbird	1	4.5
Eastern Meadowlark	6	9.1
Eastern Towhee	1	4.5
Eastern Wood-Pewee	8	27.3
Field Sparrow	4	9.1
Grasshopper Sparrow	2	4.5
Wood Thrush	5	13.6
Yellow-billed Cuckoo	5	22.7
<b>Stewardship Species</b>		
Acadian Flycatcher	2	9.1
Blue Grosbeak	3	13.6
Carolina Chickadee	5	13.6
Carolina Wren	14	63.6
Downy Woodpecker	4	13.6
Indigo Bunting	17	50.0
Northern Parula	1	4.5
Pileated Woodpecker	2	9.1
Pine Warbler	1	4.5
Purple Martin	-	-
Red-bellied Woodpecker	8	27.3
Summer Tanager	2	9.1
Yellow-throated Vireo	1	4.5

Number of detections of Partners in Flight (PIF) watchlist and stewardship species and percent of stations with detections at Appomattox Court House NHP in 2011. Detections exclude flyovers and incidental encounters..

### References:

O'Connell, et al. 2003. A bird community index for the Mid-Atlantic Piedmont and Coastal Plain. Final Report to the USGS - Patuxent Wildlife Research Center. Report No. 2003-02.

### Photographs by:

Jim Schmidt and Bill Thompson

March 2012

Figure 2. 2011 Resource Brief for Appomattox Court House NHP (continued).



**Table 7.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence between 2010 and 2011 at Appomattox Court House NHP. Closed circles indicate species that were detected in a station while open circles indicate species that were only detected as flyovers or incidentals.

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected	
			2010	2011
Red-eyed Vireo	1.55 $\pm$ 0.31	72.73	●	●
Barn Swallow	0.91 $\pm$ 0.47	18.18	●	●
Tufted Titmouse	0.82 $\pm$ 0.18	54.55	●	●
Indigo Bunting†	0.77 $\pm$ 0.20	50.00	●	●
Chimney Swift*	0.68 $\pm$ 0.46	13.64	●	●
Northern Cardinal	0.68 $\pm$ 0.19	45.45	●	●
Carolina Wren†	0.64 $\pm$ 0.10	63.64	●	●
European Starling <sup>1</sup>	0.59 $\pm$ 0.55	9.09	●	●
Ovenbird	0.45 $\pm$ 0.21	27.27	●	●
American Crow	0.36 $\pm$ 0.15	27.27	●	●
Eastern Wood-Pewee*	0.36 $\pm$ 0.14	27.27	●	●
Red-bellied Woodpecker†	0.36 $\pm$ 0.14	27.27	●	●
White-breasted Nuthatch	0.36 $\pm$ 0.14	27.27	●	●
Eastern Meadowlark*	0.27 $\pm$ 0.20	9.09	●	●
Carolina Chickadee†	0.23 $\pm$ 0.13	13.64	●	●
Mourning Dove	0.23 $\pm$ 0.09	22.73	●	●
Wood Thrush*	0.23 $\pm$ 0.15	13.64	●	●
Yellow-billed Cuckoo*	0.23 $\pm$ 0.09	22.73	●	●
Blue Jay	0.18 $\pm$ 0.08	18.18	●	●
Common Yellowthroat	0.18 $\pm$ 0.11	13.64	●	●
Downy Woodpecker†	0.18 $\pm$ 0.11	13.64	●	●
Field Sparrow*	0.18 $\pm$ 0.14	9.09	●	●
Scarlet Tanager	0.18 $\pm$ 0.08	18.18	●	●
Blue Grosbeak†	0.14 $\pm$ 0.07	13.64	●	●
Common Grackle	0.14 $\pm$ 0.07	13.64	●	●
Great Crested Flycatcher	0.14 $\pm$ 0.10	9.09	●	●
Acadian Flycatcher†	0.09 $\pm$ 0.06	9.09	●	●
American Goldfinch	0.09 $\pm$ 0.09	4.55	●	●
Blue-gray Gnatcatcher	0.09 $\pm$ 0.06	9.09	●	●
Brown-headed Cowbird	0.09 $\pm$ 0.06	9.09	●	●
Eastern Bluebird	0.09 $\pm$ 0.06	9.09		●
Grasshopper Sparrow*	0.09 $\pm$ 0.09	4.55	●	●
Pileated Woodpecker†	0.09 $\pm$ 0.06	9.09		●
Summer Tanager†	0.09 $\pm$ 0.06	9.09	●	●
American Redstart	0.05 $\pm$ 0.05	4.55		●
American Robin	0.05 $\pm$ 0.05	4.55	●	●



**Table 7.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence between 2010 and 2011 at Appomattox Court House NHP (continued).

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected	
			2010	2011
Belted Kingfisher	0.05 $\pm$ 0.05	4.55		●
Brown Thrasher*	0.05 $\pm$ 0.05	4.55		●
Chipping Sparrow	0.05 $\pm$ 0.05	4.55	●	●
Eastern Kingbird*	0.05 $\pm$ 0.05	4.55	●	●
Eastern Towhee*	0.05 $\pm$ 0.05	4.55	●	●
Northern Mockingbird	0.05 $\pm$ 0.05	4.55	●	●
Northern Parula†	0.05 $\pm$ 0.05	4.55	●	●
Pine Warbler†	0.05 $\pm$ 0.05	4.55	●	●
Ruby-throated Hummingbird	0.05 $\pm$ 0.05	4.55	●	●
Yellow-throated Vireo†	0.05 $\pm$ 0.05	4.55	●	●
Yellow-throated Warbler	0.05 $\pm$ 0.05	4.55		●
Purple Martin†	-	-		○
Turkey Vulture	-	-	●	○
Cedar Waxwing	-	-	●	
Great Blue Heron	-	-	●	
Northern Bobwhite*	-	-	●	
Northern Flicker*	-	-	●	
Orchard Oriole†	-	-	●	
Red-shouldered Hawk†	-	-	●	
Red-tailed Hawk	-	-	●	
Yellow-breasted Chat	-	-	●	

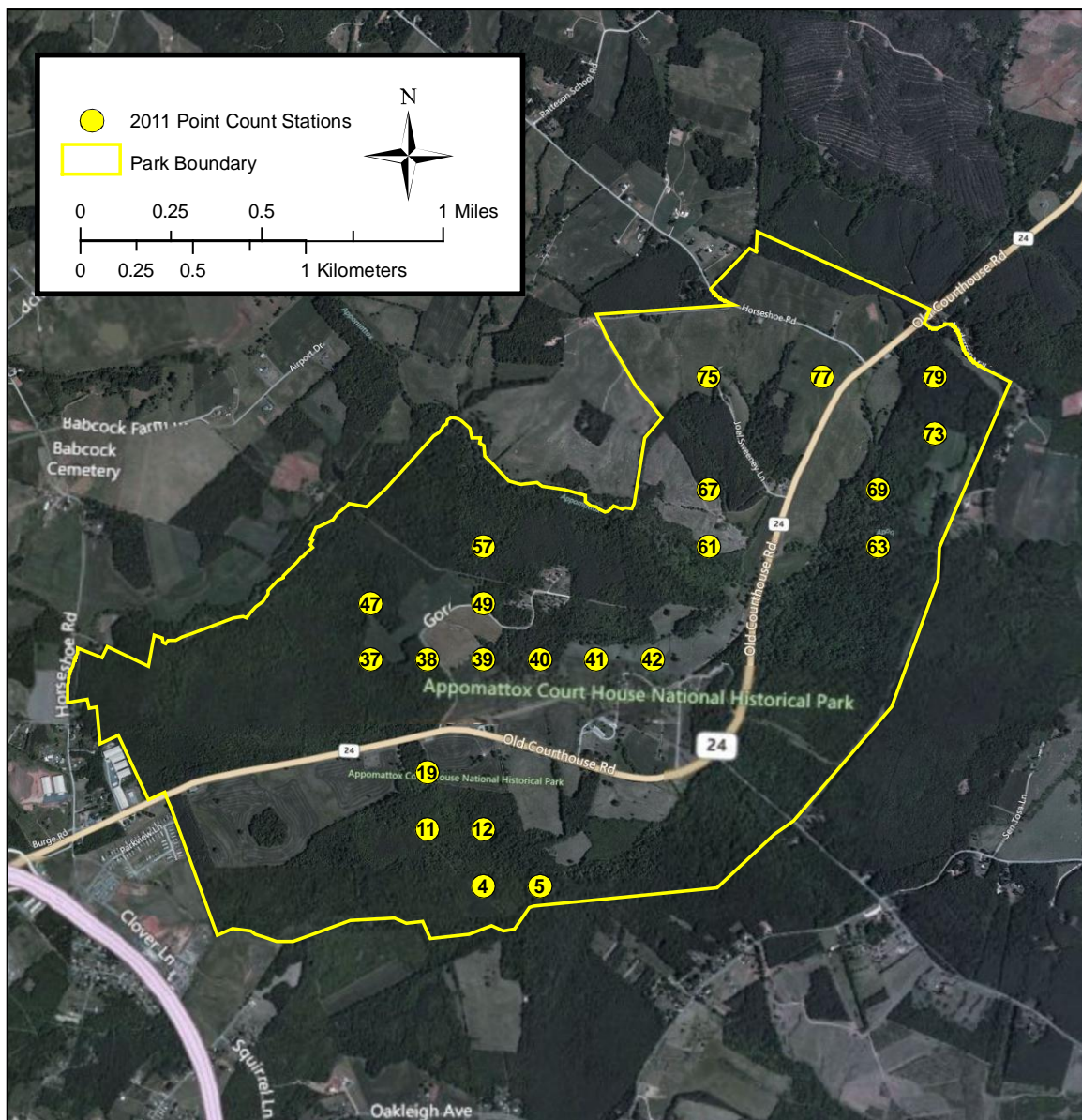
\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, †Exotic species



**Table 8.** Avian forest guild summary and Bird Community Index (BCI) score for 2010 and 2011 at Appomattox Court House NHP. Percents indicate the average percent guild membership at monitoring locations. Total BCI scores range from 0-1 with 1 having the highest integrity. Ranks are derived from O'Connell et al. (2003).

		2010 (n=29)		2011 (n=16)	
	Guild	Percent	Rank	Percent	Rank
Structural	Forest Interior	22.77	Largely Intact	29.55	Naturalistic
	Pine Associated	2.92	Largely Intact	0.89	Moderately Disturbed
	Urban/Suburban	42.50	Largely Intact	37.04	Largely Intact
Functional	Bark Prober	16.42	Largely Intact	22.16	Naturalistic
	Ground Forager	2.49	Moderately Disturbed	5.55	Largely Intact
	Upper Canopy Forager	28.93	Naturalistic	24.55	Naturalistic
Compositional	Nest Predator/Brood Parasite	18.52	Moderately Disturbed	11.49	Largely Intact
	Single Brooded	46.02	Naturalistic	50.19	Naturalistic
	Exotic	0.00	Naturalistic	0.00	Naturalistic
Total BCI Score		0.78	Naturalistic	0.86	Naturalistic





**Figure 3.** Bird monitoring stations sampled at Appomattox Court House NHP in 2011.



## Booker T. Washington National Monument

Northeast Region  
Inventory & Monitoring Program

National Park Service  
U.S. Department of the Interior



### Mid-Atlantic Network

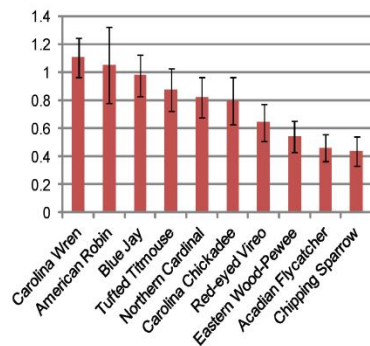
### Breeding Bird Resource Brief



Baltimore Oriole

#### Booker T. Washington National Monument 2011 Status & Trends

This year, 16 bird monitoring stations were surveyed at Booker T. Washington NM, including 12 stations in forested habitats and 4 in grassland habitats. Six volunteer birders from the local birding community conducted an average of 3.5 surveys per station producing a total of 56 surveys for the season.



The 10 most commonly detected bird species at Booker T. Washington NM in 2011 and their associated relative abundance (average birds/station). Error bars indicate standard error, a measure of variation.

Between June and July, 805 birds of 54 species were detected throughout the park. A few species were detected this year that were not in previous monitoring years including the Chimney Swift, Red-winged Blackbird, and Barred Owl.

The 10 most abundant species were the American Crow, Red-eyed Vireo, Chipping Sparrow, Tufted Titmouse, Eastern Wood-Pewee, Blue-gray Gnatcatcher, Indigo Bunting, Northern Cardinal, Carolina Chickadee, and Mourning Dove. This year was the year of the American Crow for Booker T. Washington NM, whose average abundance was 2.4 birds / station and crows were detected at nearly all the stations (93.8% of stations surveyed).

Species of conservation concern, as defined by Partners in Flight (PIF), were well represented in the park, with volunteers detecting 24 species (see table on back right). PIF further distinguishes

#### Objectives

1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of relationships between breeding birds, habitats and park management.

species of concern as “watchlist” species, which face immediate threats, or “stewardship” species, which are representative of avifaunal biomes that may or may not be in immediate danger. Within the park, 11 watchlist species and 13 stewardship species were detected. Three species of concern, including a watchlist species (i.e. Eastern Wood-Pewee) and 2 stewardship species (i.e. Indigo Bunting and Carolina Chickadee), were among the 10 most abundant species.

Avian guilds, or groups of species occupying similar ecological niches, can be utilized for assessing response to environmental changes and ecosystem



Tufted Titmouse

#### Importance

In the densely populated Mid-Atlantic region, birds face numerous threats including urbanization, habitat loss, and fragmentation. National parks provide refuge from such threats with contiguous and protected tracts of habitat suitable for breeding birds. These parks host species of continental concern and other species that are declining throughout their range.

Birds are also excellent barometers of ecosystem health due to their high metabolism and prominent position in the food web. Detecting changes in bird populations may help alert park staff to ecological stressors such as invasive species, overbrowsing, detrimental park management practices, or climate change and help guide future management actions.

**Figure 4.** 2011 Resource Brief for Booker T. Washington NM. A high resolution version may be downloaded from <http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>.



## Management Applications

- A total of 54 species were detected across the park including 24 species of concern.
- The Eastern Wood-Pewee, a watchlist species, was the fifth most common species in the park.
- The park's forested stations maintained the highest ecological integrity rank measured using a Bird Community Index (BCI).

## Long-term Monitoring

Between May and July of each year, volunteer birders conduct point counts at monitoring stations in forest and grassland habitats. Stations in forested areas are located within 125 m of forest vegetation monitoring plots enabling park staff to associate long-term trends in vegetation with avian population trends.

During each 10-minute count, the volunteer records environmental

conditions, how the bird was detected (visually or aurally), and the distance and minute of first detection.

Each site is visited at least once, but volunteers are encouraged to make multiple visits in a season. Multiple visits are especially important for obtaining accurate density estimates as information on variability due to observers, weather, etc. can be accounted for.

## Status & Trends Continued...

stressors via bird community assessments, or "indices" (BCIs). Based on a BCI developed for the Piedmont/Coastal Plain region (O'Connell et al. 2003), forested stations surveyed in the park maintained their ecological rank

of "naturalistic", the highest rank available in the metric. All guilds scored highly with the exception of the pine associated guild, and none of the guilds deteriorated in ecological rank.

		2010		2011	
Guild		Percent	Rank	Percent	Rank
Structural	Forest Interior	43.05	Naturalistic	37.48	Naturalistic
	Pine Associated	1.42	Moderately Disturbed	0.38	Moderately Disturbed
	Urban/Suburban	29.08	Largely Intact	33.57	Largely Intact
Functional	Bark Prober	18.91	Largely Intact	19.44	Largely Intact
	Ground Forager	6.80	Largely Intact	5.52	Largely Intact
	Upper Canopy Forager	25.27	Naturalistic	23.84	Naturalistic
Compositional	Nest Predator/Brood Parasite	11.88	Largely Intact	12.68	Largely Intact
	Single Brooded	56.65	Naturalistic	52.83	Naturalistic
	Exotic	0.00	Naturalistic	0.00	Naturalistic
Total BCI Score		0.83	Naturalistic	0.83	Naturalistic

Avian forest guild summary and Bird Community Index (BCI) score for 2010-2011. Percents indicate the average percent guild membership at monitoring locations across the park. Total BCI scores range from 0-1 with 1 having the highest integrity.

## A Final Note

It is important to note that the data presented in this brief is preliminary as variability in the dataset has not yet been accounted for. For more information on this protocol, please see the full annual report accessible from the protocol website linked below.

We'd like to thank all our volunteers for walking off the beaten path in the summer heat to count birds: Marshall Daniels, Ingrid Freeborn, Laurie Greer, Tim Quinn, Anne Tucker, and Bill Tucker.

Species	Detections	% Occupied
Watchlist Species		
Brown Thrasher	1	6.3
Chimney Swift	1	6.3
Eastern Kingbird	4	18.8
Eastern Meadowlark	11	37.5
Eastern Towhee	11	43.8
Eastern Wood-Pewee	19	87.5
Field Sparrow	11	31.3
Grasshopper Sparrow	3	6.3
Prairie Warbler	2	12.5
Wood Thrush	16	62.5
Yellow-billed Cuckoo	12	62.5
Stewardship Species		
Acadian Flycatcher	7	37.5
Blue Grosbeak	1	6.3
Carolina Chickadee	16	75.0
Carolina Wren	15	68.8
Downy Woodpecker	5	31.3
Indigo Bunting	18	62.5
Northern Parula	2	12.5
Orchard Oriole	1	6.3
Pileated Woodpecker	8	43.8
Pine Warbler	1	6.3
Red-bellied Woodpecker	7	43.8
Red-shouldered Hawk	-	-
Yellow-throated Vireo	6	31.3

Number of detections of Partners in Flight (PIF) watchlist and stewardship species and percent of stations with detections at Booker T. Washington NM in 2011. Detections exclude flyovers and incidental encounters.

### References:

O'Connell, et al. 2003. A bird community index for the Mid-Atlantic Piedmont and Coastal Plain. Final Report to the USGS - Patuxent Wildlife Research Center. Report No. 2003-02.

### Photographs:

Baltimore Oriole: Jim Schmidt  
Tufted Titmouse: Bill Thompson



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**Protocol Website:**  
More information and full annual reports may be found at  
<http://science.nature.nps.gov/im/units/imdn/ProtocolBirds.cfm>

March 2012

Figure 4. 2011 Resource Brief for Booker T. Washington NM (continued).



**Table 9.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence from 2009-2011 at Booker T. Washington NM. Closed circles indicate species that were detected in a station while open circles indicate species that were only detected as flyovers or incidentals.

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected		
			2009	2010	2011
American Crow	2.38 $\pm$ 0.33	93.75	●	●	●
Red-eyed Vireo	1.44 $\pm$ 0.20	87.5	●	●	●
Chipping Sparrow	1.31 $\pm$ 0.43	56.25	●	●	●
Tufted Titmouse	1.25 $\pm$ 0.23	87.5	●	●	●
Eastern Wood-Pewee*	1.19 $\pm$ 0.16	87.5	●	●	●
Blue-gray Gnatcatcher	1.13 $\pm$ 0.22	81.25	●	●	●
Indigo Bunting†	1.13 $\pm$ 0.29	62.5	●	●	●
Northern Cardinal	1.06 $\pm$ 0.25	75	●	●	●
Carolina Chickadee†	1.00 $\pm$ 0.20	75	●	●	●
Mourning Dove	1.00 $\pm$ 0.22	68.75	●	●	●
Wood Thrush*	1.00 $\pm$ 0.24	62.5	●	●	●
Blue Jay	0.94 $\pm$ 0.25	56.25	●	●	●
Carolina Wren†	0.94 $\pm$ 0.19	68.75	●	●	●
White-breasted Nuthatch	0.94 $\pm$ 0.28	50	●	●	●
Ovenbird	0.88 $\pm$ 0.22	62.5	●	●	●
Scarlet Tanager	0.81 $\pm$ 0.21	62.5	●	●	●
Yellow-billed Cuckoo*	0.75 $\pm$ 0.17	62.5	●	●	●
Brown-headed Cowbird	0.69 $\pm$ 0.24	43.75	●	●	●
Eastern Meadowlark*	0.69 $\pm$ 0.27	37.5	●	●	●
Eastern Towhee*	0.69 $\pm$ 0.22	43.75	●	●	●
Field Sparrow*	0.69 $\pm$ 0.27	31.25	●	●	●
Eastern Bluebird	0.56 $\pm$ 0.20	37.5	●	●	●
Pileated Woodpecker†	0.50 $\pm$ 0.16	43.75	●	●	●
Acadian Flycatcher†	0.44 $\pm$ 0.16	37.5	●	●	●
American Goldfinch	0.44 $\pm$ 0.16	37.5	●	●	●
Eastern Phoebe	0.44 $\pm$ 0.18	31.25	●	●	●
Red-bellied Woodpecker†	0.44 $\pm$ 0.13	43.75	●	●	●
Yellow-throated Vireo†	0.38 $\pm$ 0.15	31.25	●	●	●
Downy Woodpecker†	0.31 $\pm$ 0.12	31.25	●	●	●
Northern Mockingbird	0.31 $\pm$ 0.15	25	●	●	●
Eastern Kingbird*	0.25 $\pm$ 0.14	18.75		●	●
European Starling <sup>1</sup>	0.25 $\pm$ 0.25	6.25	○		●
Barn Swallow	0.19 $\pm$ 0.14	12.5	○	●	●
Common Yellowthroat	0.19 $\pm$ 0.14	12.5	●	●	●
Grasshopper Sparrow*	0.19 $\pm$ 0.19	6.25	●	●	●
American Robin	0.13 $\pm$ 0.09	12.5	●	●	●
Louisiana Waterthrush	0.13 $\pm$ 0.09	12.5	●	●	●



**Table 9.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence from 2009-2011 at Booker T. Washington NM (continued).

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected		
			2009	2010	2011
Northern Parula†	0.13 ± 0.09	12.5	●	○	●
Prairie Warbler*	0.13 ± 0.09	12.5	○	●	●
Red-winged Blackbird	0.13 ± 0.13	6.25			●
Ruby-throated Hummingbird	0.13 ± 0.09	12.5		●	●
Barred Owl	0.06 ± 0.06	6.25			●
Blue Grosbeak†	0.06 ± 0.06	6.25		●	●
Brown Thrasher*	0.06 ± 0.06	6.25	●		●
Chimney Swift*	0.06 ± 0.06	6.25			●
Common Grackle	0.06 ± 0.06	6.25		●	●
Great Blue Heron	0.06 ± 0.06	6.25	○	●	●
Great Crested Flycatcher	0.06 ± 0.06	6.25	●	○	●
House Finch	0.06 ± 0.06	6.25			●
Northern Rough-winged Swallow	0.06 ± 0.06	6.25	○	●	●
Orchard Oriole†	0.06 ± 0.06	6.25		○	●
Pine Warbler†	0.06 ± 0.06	6.25	●	●	●
American Redstart	-	-		●	
Baltimore Oriole*	-	-		●	
Black Vulture	-	-		○	
Blackpoll Warbler	-	-		●	
Canada Warbler	-	-	●		
Cedar Waxwing	-	-	●	●	○
Hairy Woodpecker	-	-	○	●	
Killdeer	-	-	●	●	
Northern Flicker*	-	-	●	●	
Red-shouldered Hawk†	-	-	●	●	○
Red-tailed Hawk	-	-	●	○	
Summer Tanager†	-	-	●	●	
Turkey Vulture	-	-	●	●	
White-eyed Vireo†	-	-		○	
Worm-eating Warbler*	-	-		●	

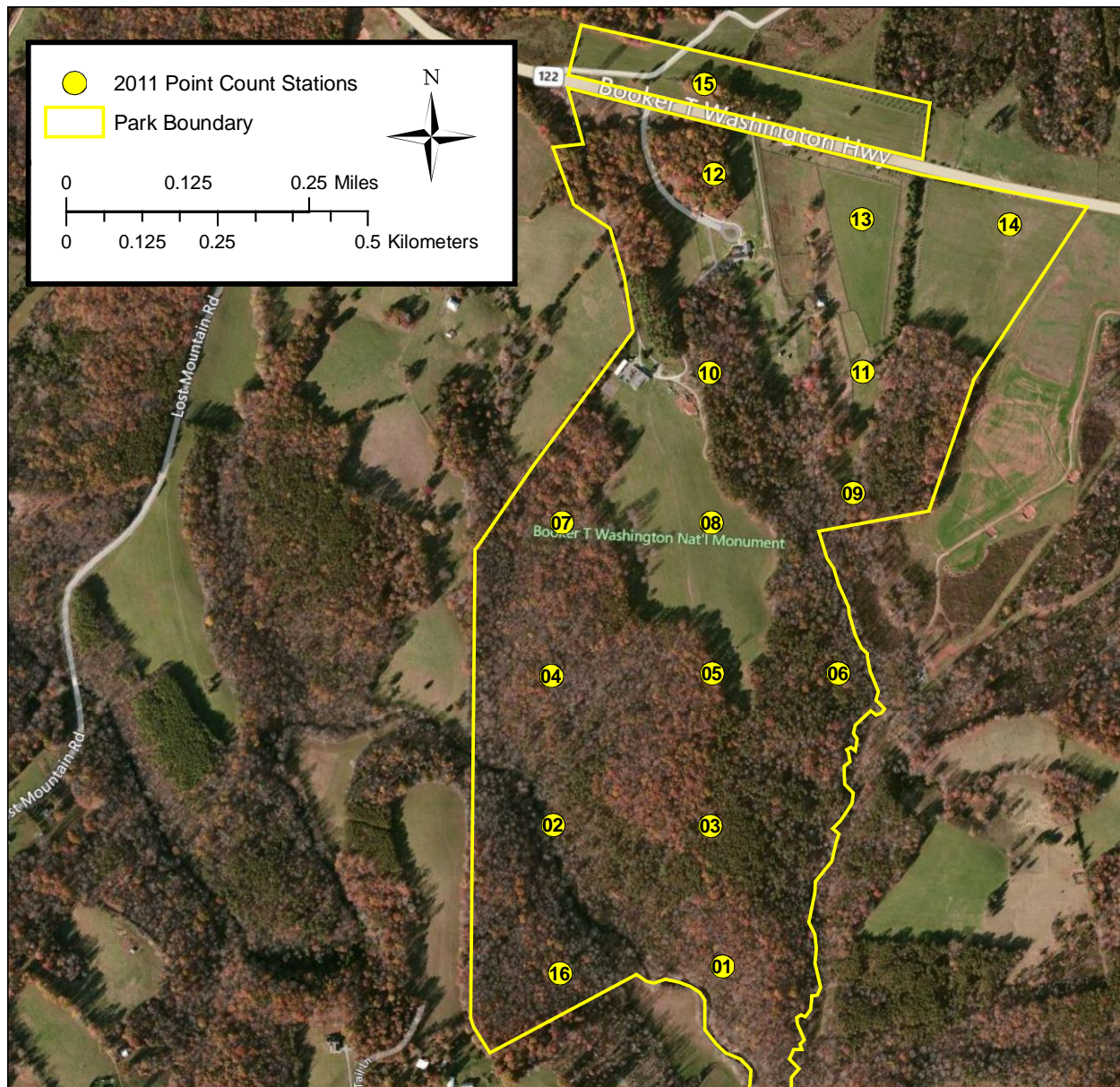
\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, †Exotic species



**Table 10.** Avian forest guild summary and Bird Community Index (BCI) score for 2009 – 2011 at Booker T. Washington NM. Percents indicate the average percent guild membership at monitoring locations. Total BCI scores range from 0-1 with 1 having the highest integrity. Ranks are derived from O’Connell et al. (2003).

		2009 (n=41)		2010 (n=31)		2011 (n=41)	
Guild		Percent	Rank	Percent	Rank	Percent	Rank
Structural	Forest Interior	34.93	Naturalistic	43.05	Naturalistic	37.48	Naturalistic
	Pine Associated	0.00	Humanistic	1.42	Moderately Disturbed	0.38	Moderately Disturbed
	Urban/Suburban	43.59	Largely Intact	29.08	Largely Intact	33.57	Largely Intact
Functional	Bark Prober	16.73	Largely Intact	18.91	Largely Intact	19.44	Largely Intact
	Ground Forager	6.48	Largely Intact	6.80	Largely Intact	5.52	Largely Intact
	Upper Canopy Forager	17.32	Largely Intact	25.27	Naturalistic	23.84	Naturalistic
Compositional	Nest Predator/Brood Parasite	18.30	Moderately Disturbed	11.88	Largely Intact	12.68	Largely Intact
	Single Brooded	45.78	Largely Intact	56.65	Naturalistic	52.83	Naturalistic
	Exotic	0.00	Naturalistic	0.00	Naturalistic	0.00	Naturalistic
Total BCI Score		0.72	Largely Intact	0.83	Naturalistic	0.83	Naturalistic





**Figure 5.** Bird monitoring stations sampled at Booker T. Washington NM in 2011.



# Fredericksburg and Spotsylvania National Military Park

Northeast Region  
Inventory & Monitoring Program

National Park Service  
U.S. Department of the Interior



## Mid-Atlantic Network

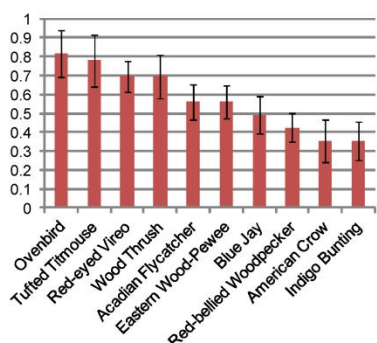
## Breeding Bird Resource Brief



Baltimore Oriole

### Fredericksburg and Spotsylvania National Military Park 2011 Status & Trends

This year, a total of 59 bird monitoring stations were surveyed at the Spotsylvania Battlefield in Fredericksburg and Spotsylvania NMP, including 51 stations in forested habitats and 8 stations in grassland habitats. Seven volunteer birders from the local birding community conducted an average of 1.31 surveys per



The 10 most commonly detected bird species at Fredericksburg and Spotsylvania NMP in 2011 and their associated relative abundance (average birds/station). Error bars indicate standard error, a measure of variation.

station producing a total of 77 surveys for the season.

Between May and July, 703 birds of 56 species were detected throughout the park. No new species were detected this year and species counts were slightly lower than in previous years (i.e. 58 species in 2009 and 63 in 2010), but this is likely a reflection of the lower number of surveys conducted this year (i.e. 116 surveys in 2009 and 103 in 2010) than a decline in species richness. The Ovenbird was the most numerous species averaging 0.8 birds / station. The Red-eyed Vireo was the most prevalent, occurring at 61% of the stations surveyed.

Volunteers detected 28 species of conservation concern, as defined by Partners in Flight (PIF), (see table on back right), consistent with surveys from previous years. PIF further distinguishes species of concern as “watchlist” species, which face immediate threats, or

### Objectives

1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of relationships between breeding birds, habitats and park management.

“stewardship” species, which are representative of avifaunal biomes that may or may not be in immediate danger. Within the park, 13 watchlist species and 15 stewardship species were detected. Five species of concern, including 2 watchlist species (i.e. Wood Thrush and Eastern Wood-Pewee) and 3 stewardship species (i.e. Acadian Flycatcher, Red-bellied Woodpecker, and Indigo Bunting), were among the 10 most abundant species.

Avian guilds, or groups of species occupying similar ecological niches, can be utilized for assessing response to environmental changes and ecosystem stressors via bird community assess-



Tufted Titmouse

### Importance

In the densely populated Mid-Atlantic region, birds face numerous threats including urbanization, habitat loss, and fragmentation. National parks provide refuge from such threats with contiguous and protected tracts of habitat suitable for breeding birds. These parks host species of continental concern and other species that are declining throughout their range.

Birds are also excellent barometers of ecosystem health due to their high metabolism and prominent position in the food web. Detecting changes in bird populations may help alert park staff to ecological stressors such as invasive species, overbrowsing, detrimental park management practices, or climate change and help guide future management actions.

**Figure 6.** 2011 Resource Brief for Fredericksburg and Spotsylvania NMP. A high resolution version may be downloaded from <http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>.



### Management Applications

- A total of 56 species were detected across the park including 28 species of concern.
- Throughout the park, 5 out of the 10 most common species detected were species of concern.
- The park's forested stations maintained the highest ecological integrity ranking, using a Bird Community Index (BCI).

### Long-term Monitoring

Between May and July of each year, volunteer birders conduct point counts at monitoring stations in forest and grassland habitats. Stations in forested areas are located within 125 m of forest vegetation monitoring plots enabling park staff to associate long-term trends in vegetation with avian population trends.

During each 10-minute count, the volunteer records environmental

conditions, how the bird was detected (visually or aurally), and the distance and minute of first detection.

Each site is visited at least once, but volunteers are encouraged to make multiple visits in a season. Multiple visits are especially important for obtaining accurate density estimates as information on variability due to observers, weather, etc. can be accounted for.

### Status & Trends Continued...

a BCI developed for the Piedmont/Coastal Plain region (O'Connell et al. 2003), forested stations surveyed this year maintained the highest ecological ranking of "naturalistic." Ranks per guild were also consistent with last year, with the exception of the ground foraging guild, which scored higher

likely due to the large number of Oven-birds detected this year.

#### References:

O'Connell, et al. 2003. A bird community index for the Mid-Atlantic Piedmont and Coastal Plain. Final Report to the USGS – Patuxent Wildlife Research Center. Report No. 2003-02.

#### Photographs by:

Jim Schmidt and Bill Thompson

		2010		2011	
Guild		Percent	Rank	Percent	Rank
Structural	Forest Interior	36.10	Naturalistic	44.13	Naturalistic
	Pine Associated	0.42	Moderately Disturbed	1.20	Moderately Disturbed
	Urban/Suburban	33.57	Largely Intact	24.90	Largely Intact
Functional	Bark Prober	20.98	Naturalistic	21.94	Naturalistic
	Ground Forager	5.88	Largely Intact	10.49	Naturalistic
	Upper Canopy Forager	23.37	Naturalistic	19.04	Naturalistic
Compositional	Nest Predator/Brood Parasite	15.72	Largely Intact	12.54	Largely Intact
	Single Brooded	56.06	Naturalistic	64.75	Naturalistic
	Exotic	0.00	Naturalistic	0.00	Naturalistic
Total BCI Score		0.86	Naturalistic	0.89	Naturalistic

Avian forest guild summary and Bird Community Index (BCI) score for 2010-2011. Percents indicate the average percent guild membership at monitoring locations across the park. Total BCI scores range from 0-1 with 1 having the highest integrity.

### A Final Note

It is important to note that the data presented in this brief is preliminary as variability in the dataset has not yet been accounted for. For more information on this protocol, please see the full annual report accessible from the protocol website linked below.

Last but not least, we'd like to thank all our volunteers for walking off the beaten path in the summer heat to collect the data summarized in this brief.

Species	Detections	% Occupied
Watchlist Species		
Acadian Flycatcher	33	42.37
Brown Thrasher	1	1.69
Chimney Swift	-	-
Eastern Towhee	2	3.39
Eastern Wood-Pewee	33	47.46
Field Sparrow	9	10.17
Kentucky Warbler	1	1.69
Northern Flicker	3	5.08
Prairie Warbler	3	5.08
Willow Flycatcher	1	1.69
Wood Thrush	41	47.46
Worm-eating Warbler	2	3.39
Yellow-billed Cuckoo	17	27.12
Stewardship Species		
Blue Grosbeak	1	1.69
Carolina Chickadee	18	25.42
Carolina Wren	16	22.03
Downy Woodpecker	6	10.17
Hooded Warbler	1	1.69
Indigo Bunting	21	23.73
Northern Parula	1	1.69
Orchard Oriole	4	6.78
Pileated Woodpecker	16	25.42
Pine Warbler	8	11.86
Red-bellied Woodpecker	25	37.29
Red-shouldered Hawk	-	-
Summer Tanager	3	5.08
White-eyed Vireo	1	1.69
Yellow-throated Vireo	1	1.69

Number of detections of Partners in Flight (PIF) watchlist and stewardship species and percent of stations with detections at Fredericksburg and Spotsylvania NMP in 2011. Detections exclude flyovers and incidental encounters.



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More information and full annual reports may be found at  
<http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>

April 2012

Figure 6. 2011 Resource Brief for Fredericksburg and Spotsylvania NMP (continued).



**Table 11.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence from 2009-2011 at Spotsylvania Battlefield, Fredericksburg and Spotsylvania NMP. Closed circles indicate species that were detected in a station while open circles indicate species that were only detected as flyovers or incidentals.

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected		
			2009	2010	2011
Ovenbird	0.81 $\pm$ 0.12	54.24	●	●	●
Tufted Titmouse	0.78 $\pm$ 0.14	50.85	●	●	●
Red-eyed Vireo	0.69 $\pm$ 0.08	61.02	●	●	●
Wood Thrush*	0.69 $\pm$ 0.12	47.46	●	●	●
Acadian Flycatcher†	0.56 $\pm$ 0.09	42.37	●	●	●
Eastern Wood-Pewee*	0.56 $\pm$ 0.09	47.46	●	●	●
Blue Jay	0.49 $\pm$ 0.1	35.59	●	●	●
Red-bellied Woodpecker†	0.42 $\pm$ 0.08	37.29	●	●	●
American Crow	0.36 $\pm$ 0.11	22.03	●	●	●
Indigo Bunting†	0.36 $\pm$ 0.1	23.73	●	●	●
Mourning Dove	0.34 $\pm$ 0.08	28.81	●	●	●
Scarlet Tanager	0.32 $\pm$ 0.07	27.12	●	●	●
Carolina Chickadee†	0.31 $\pm$ 0.08	25.42	●	●	●
Northern Cardinal	0.29 $\pm$ 0.07	25.42	●	●	●
White-breasted Nuthatch	0.29 $\pm$ 0.06	27.12	●	●	●
Yellow-billed Cuckoo*	0.29 $\pm$ 0.06	27.12	●	●	●
Carolina Wren†	0.27 $\pm$ 0.07	22.03	●	●	●
Pileated Woodpecker†	0.27 $\pm$ 0.06	25.42	●	●	●
Common Yellowthroat	0.24 $\pm$ 0.08	15.25	●	●	●
Blue-gray Gnatcatcher	0.17 $\pm$ 0.05	16.95	●	●	●
Field Sparrow*	0.15 $\pm$ 0.06	10.17	●	●	●
Pine Warbler†	0.14 $\pm$ 0.05	11.86	●	●	●
Downy Woodpecker†	0.1 $\pm$ 0.04	10.17	●	●	●
American Robin	0.07 $\pm$ 0.03	6.78	●	●	●
Brown-headed Cowbird	0.07 $\pm$ 0.04	5.08	●	●	●
Eastern Phoebe	0.07 $\pm$ 0.03	6.78	●	●	●
Orchard Oriole†	0.07 $\pm$ 0.03	6.78	●	●	●
Great Crested Flycatcher	0.05 $\pm$ 0.03	5.08	●	●	●
Louisiana Waterthrush	0.05 $\pm$ 0.03	5.08		●	●
Northern Flicker*	0.05 $\pm$ 0.03	5.08	●	●	●
Prairie Warbler*	0.05 $\pm$ 0.03	5.08	●	●	●
Red-tailed Hawk	0.05 $\pm$ 0.04	3.39		●	●
Ruby-throated Hummingbird	0.05 $\pm$ 0.03	5.08		●	●
Summer Tanager†	0.05 $\pm$ 0.03	5.08	●	●	●
American Goldfinch	0.03 $\pm$ 0.02	3.39	●	●	●



**Table 11.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence from 2009-2011 at Spotsylvania Battlefield, Fredericksburg and Spotsylvania NMP (continued).

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected		
			2009	2010	2011
Chipping Sparrow	0.03 $\pm$ 0.02	3.39	●	●	●
Eastern Towhee*	0.03 $\pm$ 0.02	3.39	●	●	●
Hairy Woodpecker	0.03 $\pm$ 0.02	3.39	●	●	●
Worm-eating Warbler*	0.03 $\pm$ 0.02	3.39	●	●	●
Yellow-breasted Chat	0.03 $\pm$ 0.02	3.39	●	●	●
Barred Owl	0.02 $\pm$ 0.02	1.69	●		●
Blue Grosbeak†	0.02 $\pm$ 0.02	1.69	●	●	●
Brown Creeper	0.02 $\pm$ 0.02	1.69			●
Brown Thrasher*	0.02 $\pm$ 0.02	1.69	●	●	●
Hooded Warbler†	0.02 $\pm$ 0.02	1.69	●		●
Kentucky Warbler*	0.02 $\pm$ 0.02	1.69		●	●
Northern Parula†	0.02 $\pm$ 0.02	1.69	●	●	●
White-eyed Vireo†	0.02 $\pm$ 0.02	1.69		●	●
Willow Flycatcher*	0.02 $\pm$ 0.02	1.69			●
Yellow-throated Vireo†	0.02 $\pm$ 0.02	1.69	●	●	●
Baltimore Oriole*	-	-		●	
Barn Swallow	-	-		○	
Belted Kingfisher	-	-		●	
Canada Goose	-	-		●	
Chimney Swift*	-	-	●		○
Common Grackle	-	-	●	●	
Common Peafowl	-	-	○		
Eastern Bluebird	-	-	●	●	○
Eastern Kingbird*	-	-	●	●	
Fish Crow	-	-		●	○
Grasshopper Sparrow*	-	-	●		
Gray Catbird	-	-	●	●	
Great Blue Heron	-	-	○	○	○
Green Heron	-	-		●	
House Wren	-	-	○		
Palm Warbler	-	-		●	
Purple Martin†	-	-	○		
Red-shouldered Hawk†	-	-	●	●	○
Sharp-shinned Hawk	-	-		●	
Song Sparrow	-	-	●	●	
Tree Swallow	-	-	○		
Turkey Vulture	-	-	○	○	○
Veery	-	-		●	
Wild Turkey	-	-	●		

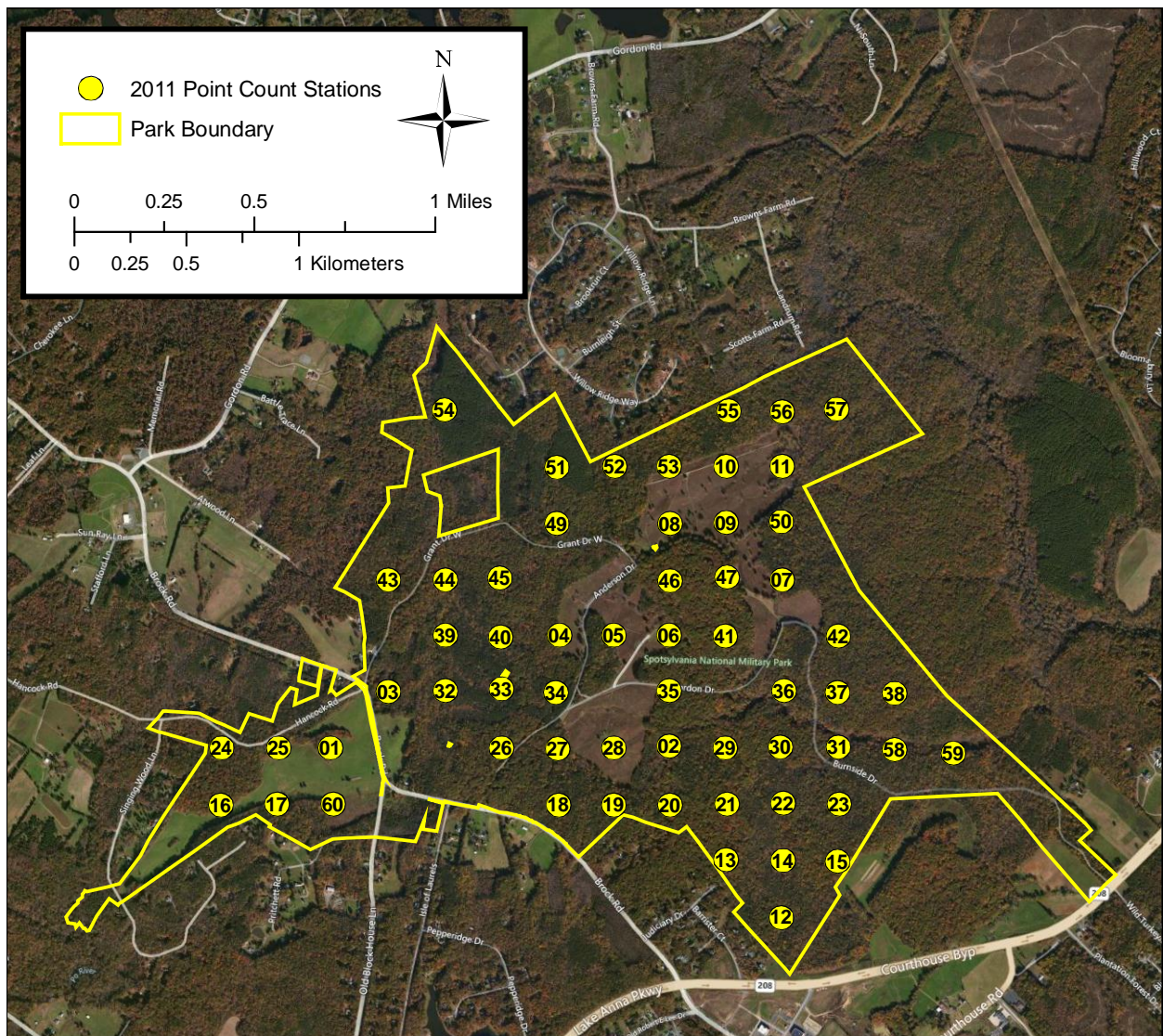
\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, †Exotic species



**Table 12.** Avian forest guild summary and Bird Community Index (BCI) score for 2009 -2011 at Spotsylvania Battlefield, Fredericksburg and Spotsylvania NMP. Percents indicate the average percent guild membership at monitoring locations. Total BCI scores range from 0-1 with 1 having the highest integrity. Ranks are derived from O’Connell et al. (2003).

		2009 (n=95)		2010 (n=86)		2011 (n=65)	
Guild		Percent	Rank	Percent	Rank	Percent	Rank
Structural	Forest Interior	40.58	Naturalistic	36.10	Naturalistic	44.13	Naturalistic
	Pine Associated	0.92	Moderately Disturbed	0.42	Moderately Disturbed	1.20	Moderately Disturbed
	Urban/Suburban	28.21	Largely Intact	33.57	Largely Intact	24.90	Largely Intact
Functional	Bark Prober	18.98	Largely Intact	20.98	Naturalistic	21.94	Naturalistic
	Ground Forager	7.49	Naturalistic	5.88	Largely Intact	10.49	Naturalistic
	Upper Canopy Forager	23.42	Naturalistic	23.37	Naturalistic	19.04	Naturalistic
Compositional	Nest Predator/Brood Parasite	9.97	Largely Intact	15.72	Largely Intact	12.54	Largely Intact
	Single Brooded	59.70	Naturalistic	56.06	Naturalistic	64.75	Naturalistic
	Exotic	0.00	Naturalistic	0.00	Naturalistic	0.00	Naturalistic
Total BCI Score		0.86	Naturalistic	0.86	Naturalistic	0.89	Naturalistic





**Figure 7.** Bird monitoring stations surveyed at Spotsylvania Battlefield, Fredericksburg and Spotsylvania NMP in 2011.



# Petersburg National Battlefield

Northeast Region  
Inventory & Monitoring Program

National Park Service  
U.S. Department of the Interior



## Mid-Atlantic Network

## Breeding Bird Resource Brief

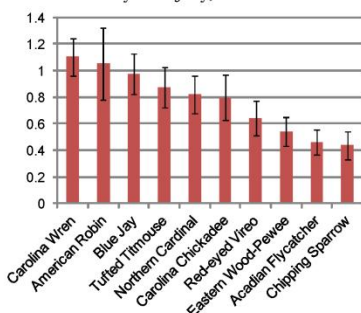


Baltimore Oriole

### Petersburg National Battlefield 2011 Status & Trends

A total of 39 stations were surveyed at the Eastern Front unit of Petersburg NB during the park's first season of breeding bird monitoring, including 32 stations in forested habitats and 7 stations in grassland habitats. Four volunteer birders conducted an average of 1.03 surveys per station producing a total of 40 surveys for the season.

Between May and July, 574 birds of 61



The 10 most commonly detected bird species at Petersburg NB in 2011 and their associated relative abundance (average birds/station). Error bars indicate standard error, a measure of variation.

species were detected throughout the park. Species richness was higher at forested stations, with 52 different species detected, versus 37 species detected at grassland stations.

The 10 most abundant species were the Carolina Wren, American Robin, Blue Jay, Tufted Titmouse, Northern Cardinal, Carolina Chickadee, Red-eyed Vireo, Eastern Wood-Pewee, Acadian Flycatcher, and Chipping Sparrow. The Carolina Wren had the highest relative abundance averaging 1.1 birds / plot and was the most prevalent species occurring at 74.3% of stations surveyed.

Several species of conservation concern, as defined by Partners in Flight (PIF), were detected in the park, with volunteers detecting 19 species (see table on back right). PIF further distinguishes species of concern as "watchlist" species, which face immediate threats, or "stewardship" species, which are rep-

### Objectives

1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of relationships between breeding birds, habitats and park management.

resentative of avifaunal biomes that may or may not be in immediate danger.

Within the park, 8 watchlist species and 11 stewardship species were detected. Four species of concern including 1 watchlist species (i.e. Eastern Wood-Pewee) and 3 stewardship species (i.e. Carolina Wren, Carolina Chickadee, and Acadian Flycatcher) were among the 10 most abundant species.

Avian guilds, or groups of species occupying similar ecological niches, can be utilized for assessing response to environmental changes and ecosystem stressors via bird community assessments, or "indices" (BCIs). Based on a BCI devel-



Tufted Titmouse

### Importance

In the densely populated Mid-Atlantic region, birds face numerous threats including urbanization, habitat loss, and fragmentation. National parks provide refuge from such threats with contiguous and protected tracts of habitat suitable for breeding birds. These parks host species of continental concern and other species that are declining throughout their range.

Birds are also excellent barometers of ecosystem health due to their high metabolism and prominent position in the food web. Detecting changes in bird populations may help alert park staff to ecological stressors such as invasive species, overbrowsing, detrimental park management practices, or climate change and help guide future management actions.

**Figure 8.** 2011 Resource Brief for Petersburg NB. A high resolution version may be downloaded from <http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>.



## Management Applications

- A total of 61 species were detected across the park including 19 species of concern.
- Four Partners in Flight (PIF) stewardship species were among the 10 most common species in the park.
- The park's forested stations received the highest ecological integrity ranking, "naturalistic", using a Bird Community Index (BCI).

## Long-term Monitoring

Between May and July of each year, volunteer birders conduct point counts at monitoring stations in forest and grassland habitats. Stations in forested areas are located within 125 m of forest vegetation monitoring plots enabling park staff to associate long-term trends in vegetation with avian population trends.

During each 10-minute count, the volunteer records environmental

conditions, how the bird was detected (visually or aurally), and the distance and minute of first detection.

Each site is visited at least once, but volunteers are encouraged to make multiple visits in a season. Multiple visits are especially important for obtaining accurate density estimates as information on variability due to observers, weather, etc. can be accounted for.

## Status & Trends Continued...

oped for the Piedmont/Coastal Plain region (O'Connell et al. 2003), forested stations surveyed this year received the highest ranking of "naturalistic".

Rankings, when broken out by guild, ranged from medium-low to high

ecological integrity (see table below).

The pine associated guild received the lowest rank of "moderately disturbed" among the guilds but this group is comprised of rare and difficult to detect species (i.e. Pine Warbler, Red-cockaded Woodpecker, etc). The bark

prober and single brooded guilds received the highest rank of "naturalistic" as species such as the Carolina Chickadee, Tufted Titmouse, and Eastern Wood-Pewee were quite prevalent.

	Guild	Percent	Rank
Structural	Forest Interior	26.16	Largely Intact
	Pine Associated	0.60	Moderately Disturbed
	Urban/Suburban	46.16	Largely Intact
Functional	Bark Prober	20.32	Naturalistic
	Ground Forager	3.68	Largely Intact
	Upper Canopy Forager	15.94	Largely Intact
Compositional	Nest Predator/Brood Parasite	14.38	Largely Intact
	Single Brooded	46.02	Naturalistic
	Exotic	0.45	Largely Intact
Total BCI Score		0.78	Naturalistic

Avian forest guild summary and Bird Community Index (BCI) score for 2011. Percents indicate the average percent guild membership at monitoring locations across the park. Total BCI scores range from 0-1 with 1 having the highest integrity.

## A Final Note

It is important to note that the data presented in this brief is preliminary as variability in the dataset has not yet been accounted for. For more information on this protocol, please see the full annual report accessible from the protocol website linked below.

We'd like to thank all our volunteers for walking off the beaten path in the summer heat to count birds: Dana Bradshaw, Victoria Summy, Amanda Vander Zanden, and Joseph Webb.



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More information and full annual reports may be found at  
<http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>

March 2012

Species	Detections	% Occupied
<b>Watchlist Species</b>		
Chimney Swift	-	-
Eastern Towhee	1	2.56
Eastern Wood-Pewee	21	43.59
Kentucky Warbler	2	5.13
Northern Flicker	7	15.38
Willow Flycatcher	3	7.69
Wood Thrush	14	30.77
Yellow-billed Cuckoo	4	10.26
<b>Stewardship Species</b>		
Acadian Flycatcher	18	41.03
Carolina Chickadee	31	48.72
Carolina Wren	43	74.36
Downy Woodpecker	11	28.21
Pileated Woodpecker	12	28.21
Pine Warbler	2	5.13
Red-bellied Woodpecker	15	30.77
Red-shouldered Hawk	1	2.56
Summer Tanager	14	28.21
White-eyed Vireo	5	10.26
Yellow-throated Vireo	4	10.26

Number of detections of Partners in Flight (PIF) watchlist and stewardship species and percent of stations with detections at Petersburg NB in 2011. Detections exclude flyovers and incidental encounters.

**References:**  
O'Connell, et al. 2003. A bird community index for the Mid-Atlantic Piedmont and Coastal Plain. Final Report to the USGS - Patuxent Wildlife Research Center. Report No. 2003-02.

**Photographs by:**  
Baltimore Oriole: Jim Schmidt  
Tufted Titmouse: Bill Thompson

Figure 8. 2011 Resource Brief for Petersburg NB (continued).



**Table 13.** Summary statistics and detection types for point count surveys conducted in 2011 at the Eastern Front, Petersburg NB. Closed circles indicate species that were detected in a station while open circles indicate species that were only detected as flyovers or incidentals.

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected 2011
Carolina Wren†	1.10 ± 0.14	74.36	●
American Robin	1.05 ± 0.27	48.72	●
Blue Jay	0.97 ± 0.15	64.10	●
Tufted Titmouse	0.87 ± 0.15	58.97	●
Northern Cardinal	0.82 ± 0.14	56.41	●
Carolina Chickadee†	0.79 ± 0.17	48.72	●
Red-eyed Vireo	0.64 ± 0.13	46.15	●
Eastern Wood-Pewee*	0.54 ± 0.11	43.59	●
Acadian Flycatcher†	0.46 ± 0.1	41.03	●
Chipping Sparrow	0.44 ± 0.10	35.90	●
American Crow	0.41 ± 0.13	23.08	●
Brown-headed Cowbird	0.41 ± 0.10	35.90	●
Red-bellied Woodpecker†	0.38 ± 0.10	30.77	●
Ovenbird	0.36 ± 0.13	23.08	●
Summer Tanager†	0.36 ± 0.11	28.21	●
Wood Thrush*	0.36 ± 0.09	30.77	●
Blue-gray Gnatcatcher	0.31 ± 0.09	25.64	●
Pileated Woodpecker†	0.31 ± 0.08	28.21	●
Barn Swallow	0.28 ± 0.10	20.51	●
Downy Woodpecker†	0.28 ± 0.07	28.21	●
Scarlet Tanager	0.23 ± 0.09	15.38	●
Great Crested Flycatcher	0.21 ± 0.08	15.38	●
American Goldfinch	0.18 ± 0.09	12.82	●
Eastern Bluebird	0.18 ± 0.10	10.26	●
Northern Flicker*	0.18 ± 0.07	15.38	●
Common Grackle	0.15 ± 0.09	10.26	●
Mourning Dove	0.15 ± 0.06	15.38	●
White-eyed Vireo†	0.13 ± 0.07	10.26	●
Horned Lark	0.10 ± 0.08	5.13	●
Northern Mockingbird	0.10 ± 0.05	10.26	●
Turkey Vulture	0.10 ± 0.08	5.13	●
Yellow-billed Cuckoo*	0.10 ± 0.05	10.26	●
Yellow-throated Vireo†	0.10 ± 0.05	10.26	●
Cedar Waxwing	0.08 ± 0.08	2.56	●
Hairy Woodpecker	0.08 ± 0.04	7.69	●
White-breasted Nuthatch	0.08 ± 0.04	7.69	●
Willow Flycatcher*	0.08 ± 0.04	7.69	●



**Table 13.** Summary statistics and detection types for point count surveys conducted in 2011 at the Eastern Front, Petersburg NB (continued).

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected 2011
Common Yellowthroat	0.05 $\pm$ 0.04	5.13	●
Eastern Phoebe	0.05 $\pm$ 0.04	5.13	●
European Starling <sup>1</sup>	0.05 $\pm$ 0.05	2.56	●
House Finch	0.05 $\pm$ 0.05	2.56	●
Kentucky Warbler*	0.05 $\pm$ 0.04	5.13	●
Killdeer	0.05 $\pm$ 0.05	2.56	●
Pine Warbler†	0.05 $\pm$ 0.04	5.13	●
Ruby-throated Hummingbird	0.05 $\pm$ 0.04	5.13	●
Wild Turkey	0.05 $\pm$ 0.05	2.56	●
Black-and-white Warbler	0.03 $\pm$ 0.03	2.56	●
Eastern Towhee*	0.03 $\pm$ 0.03	2.56	●
Gray Catbird	0.03 $\pm$ 0.03	2.56	●
Least Flycatcher	0.03 $\pm$ 0.03	2.56	●
Louisiana Waterthrush	0.03 $\pm$ 0.03	2.56	●
Nashville Warbler	0.03 $\pm$ 0.03	2.56	●
Palm Warbler	0.03 $\pm$ 0.03	2.56	●
Red-shouldered Hawk†	0.03 $\pm$ 0.03	2.56	●
Song Sparrow	0.03 $\pm$ 0.03	2.56	●
Swainson's Thrush	0.03 $\pm$ 0.03	2.56	●
Tree Swallow	0.03 $\pm$ 0.03	2.56	●
Yellow-throated Warbler	0.03 $\pm$ 0.03	2.56	●
Belted Kingfisher	-	-	○

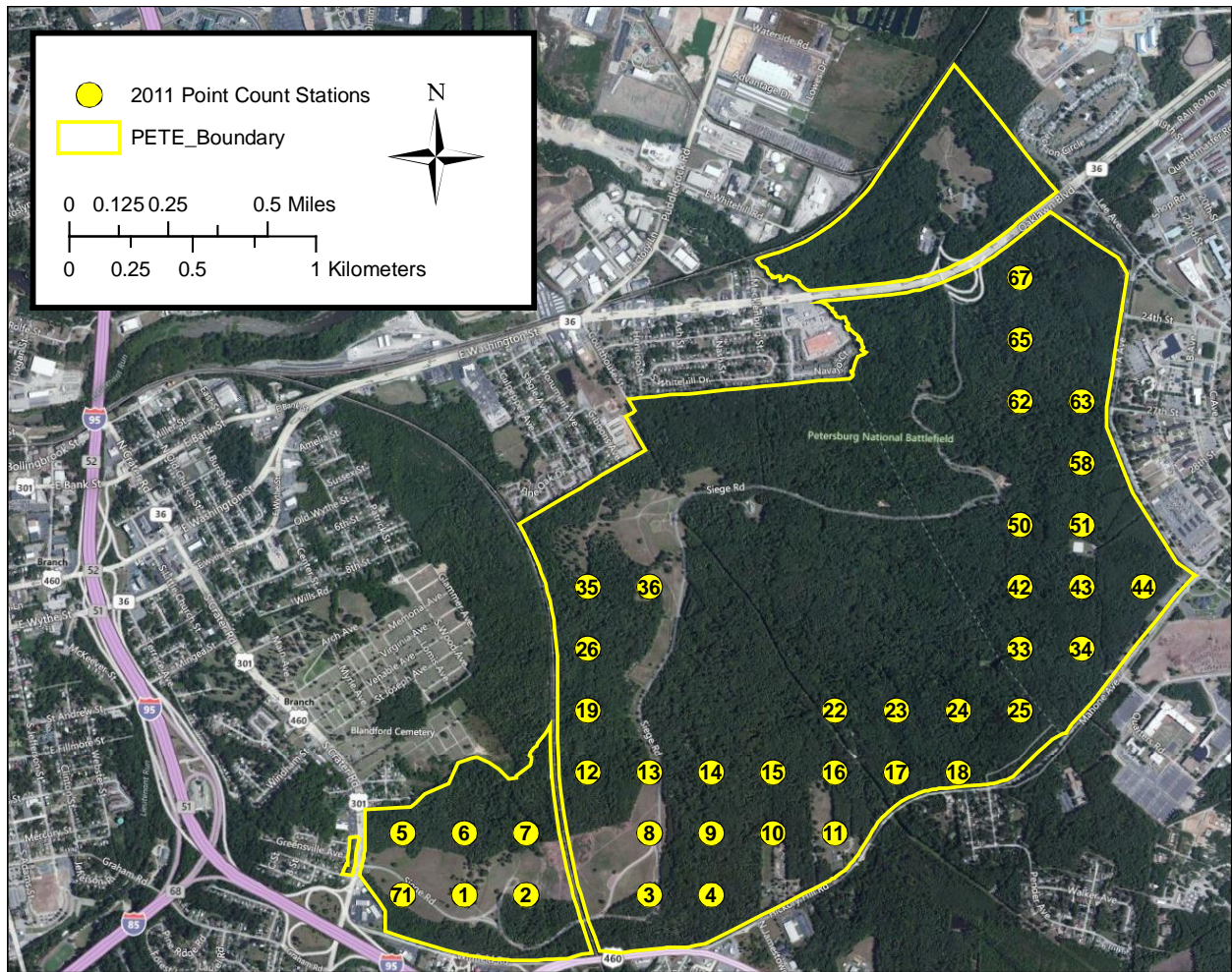
\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, <sup>1</sup>Exotic species



**Table 14.** Avian forest guild summary and Bird Community Index (BCI) score for 2011 at the Eastern Front, Petersburg NB. Percents indicate the average percent guild membership at monitoring locations. Total BCI scores range from 0-1 with 1 having the highest integrity. Ranks are derived from O'Connell et al. (2003).

		2011 (n=32)	
	Guild	Percent	Rank
Structural	Forest Interior	26.16	Largely Intact
	Pine Associated	0.60	Moderately Disturbed
	Urban/Suburban	46.16	Largely Intact
Functional	Bark Prober	20.32	Naturalistic
	Ground Forager	3.68	Largely Intact
	Upper Canopy Forager	15.94	Largely Intact
Compositional	Nest Predator/Brood Parasite	14.38	Largely Intact
	Single Brooded	46.02	Naturalistic
	Exotic	0.45	Largely Intact
Total BCI Score		0.78	Naturalistic





**Figure 9.** Bird monitoring stations surveyed at the Eastern Front, Petersburg NB in 2011.



## Richmond National Battlefield Park

Northeast Region  
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### Mid-Atlantic Network

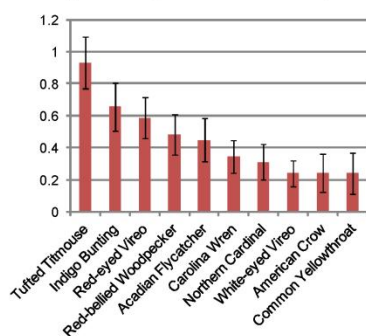
### Breeding Bird Resource Brief



Baltimore Oriole

#### Richmond National Battlefield Park 2011 Status & Trends

Of the 52 bird monitoring stations established at the Malvern Hill unit of Richmond NBP, only 29 were surveyed during the 2011 breeding bird monitoring season due to volunteer shortages. Fifteen of the stations were in forested habitats and 14 in grassland habitats. Three volunteer surveyed the stations once, producing a total of 29 surveys.



The 10 most commonly detected bird species at Richmond NBP in 2011 and their associated relative abundance (average birds/station). Error bars indicate standard error, a measure of variation.

Between May and July, 251 birds of 55 species were detected throughout the park. The number of species was similar across habitat types with 39 different species detected at forested stations, versus 40 species detected at grassland stations.

The Tufted Titmouse had the highest relative abundance, averaging 0.93 birds / station, and was the most prevalent species occurring at 62.1% of the stations surveyed.

Species of conservation concern, as defined by Partners in Flight (PIF), were well represented in the park, with volunteers detecting 24 species (see table on back right). PIF further distinguishes species of concern as “watchlist” species, which face immediate threats, or “stewardship” species, which are representative of avifaunal biomes that may or may not be in immediate danger.

#### Objectives

1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of relationships between breeding birds, habitats and park management.

Within the park, 9 watchlist species and 15 stewardship species were detected. Five species of concern (Indigo Bunting, Red-bellied Woodpecker, Acadian Flycatcher, Carolina Wren, and White-eyed Vireo) were among the 10 most abundant species.

Avian guilds, or groups of species occupying similar ecological niches, can be utilized for assessing response to environmental changes and ecosystem stressors via bird community assessments, or “indices” (BCIs). Based on a BCI developed for the Piedmont/Coastal Plain region (O’Connell et al. 2003), forested stations surveyed this year received the highest ranking of “naturalistic”, an



Tufted Titmouse

#### Importance

In the densely populated Mid-Atlantic region, birds face numerous threats including urbanization, habitat loss, and fragmentation. National parks provide refuge from such threats with contiguous and protected tracts of habitat suitable for breeding birds. These parks host species of continental concern and other species that are declining throughout their range.

Birds are also excellent barometers of ecosystem health due to their high metabolism and prominent position in the food web. Detecting changes in bird populations may help alert park staff to ecological stressors such as invasive species, overbrowsing, detrimental park management practices, or climate change and help guide future management actions.

**Figure 10.** 2011 Resource Brief for Richmond NBP. A high resolution version may be downloaded from <http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>.



## Management Applications

- A total of 55 species were detected across the park including 24 species of concern.
- 5 of the 10 most common species in the park were Partners in Flight (PIF) species of concern.
- The park's forested stations received the highest ecological integrity ranking, "naturalistic", using a Bird Community Index (BCI).

## Long-term Monitoring

Between May and July of each year, volunteer birders conduct point counts at monitoring stations in forest and grassland habitats. Stations in forested areas are located within 125 m of forest vegetation monitoring plots enabling park staff to associate long-term trends in vegetation with avian population trends.

During each 10-minute count, the volunteer records environmental

conditions, how the bird was detected (visually or aurally), and the distance and minute of first detection.

Each site is visited at least once, but volunteers are encouraged to make multiple visits in a season. Multiple visits are especially important for obtaining accurate density estimates as information on variability due to observers, weather, etc. can be accounted for.

## Status & Trends Continued...

increase from the "largely intact" ranking from 2010.

Rankings, when broken out by guild, ranged from medium to high ecological integrity (see table below). All the compositional guilds increased in rank and only the forest interior guild de-

creased in rank from last year. Results, however, are preliminary and until more data is collected should not be treated as final.

		2010		2011	
Guild		Percent	Rank	Percent	Rank
Structural	Forest Interior	30.73	Naturalistic	25.63	Largely Intact
	Pine Associated	0.58	Moderately Disturbed	2.08	Largely Intact
	Urban/Suburban	40.61	Largely Intact	27.83	Largely Intact
Functional	Bark Prober	23.58	Naturalistic	25.16	Naturalistic
	Ground Forager	6.70	Largely Intact	6.26	Largely Intact
	Upper Canopy Forager	15.99	Largely Intact	24.99	Naturalistic
Compositional	Nest Predator/Brood Parasite	24.89	Humanistic	15.13	Largely Intact
	Single Brooded	44.28	Largely Intact	47.35	Naturalistic
	Exotic	5.26	Moderately Disturbed	0.00	Naturalistic
Total BCI Score		0.69	Largely Intact	0.86	Naturalistic

Avian forest guild summary and Bird Community Index (BCI) score for 2010-2011. Percents indicate the average percent guild membership at monitoring locations across the park. Total BCI scores range from 0-1 with 1 having the highest integrity.

## A Final Note

It is important to note that the data presented in this brief is preliminary as variability in the dataset has not yet been accounted for. For more information on this protocol, please see the full annual report accessible from the protocol website linked below.

We'd like to thank all our volunteers for walking off the beaten path in the summer heat to count birds: Caroline Coe, John Coe, and Jerry Wyatt.

Species	Detections	% Occupied
Watchlist Species		
Chimney Swift	-	-
Eastern Meadowlark	-	-
Eastern Wood-Pewee	3	10.34
Field Sparrow	3	10.34
Northern Bobwhite	4	13.79
Prairie Warbler	2	6.90
Red-headed Woodpecker	2	6.90
Wood Thrush	2	6.90
Yellow-billed Cuckoo	3	10.34
Stewardship Species		
Acadian Flycatcher	13	31.03
Blue Grosbeak	4	10.34
Carolina Chickadee	3	10.34
Carolina Wren	10	31.03
Downy Woodpecker	1	3.45
Indigo Bunting	19	44.83
Northern Parula	2	6.90
Orchard Oriole	1	3.45
Pileated Woodpecker	3	6.90
Pine Warbler	2	6.90
Purple Martin	-	-
Red-bellied Woodpecker	14	37.93
Red-shouldered Hawk	1	3.45
White-eyed Vireo	7	24.14
Yellow-throated Vireo	1	3.45

Number of detections of Partners in Flight (PIF) watchlist and stewardship species and percent of stations with detections in Richmond NBP. Detections exclude flyovers and incidental encounters.

## References:

O'Connell, et al. 2003. A bird community index for the Mid-Atlantic Piedmont and Coastal Plain. Final Report to the USGS - Patuxent Wildlife Research Center. Report No. 2003-02.

## Photographs by:

Baltimore Oriole: Jim Schmidt  
Tufted Titmouse: Bill Thompson



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**Protocol Website:**  
More information and full annual reports may be found at  
<http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>

March 2012

Figure 10. 2011 Resource Brief for Richmond NBP (continued).



**Table 15.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence from 2010-2011 at Malvern Hill, Richmond NBP. Closed circles indicate species that were detected in a station while open circles indicate species that were only detected as flyovers or incidentals.

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected	
			2010	2011
Tufted Titmouse	0.93 $\pm$ 0.16	62.07	●	●
Indigo Bunting†	0.66 $\pm$ 0.15	44.83	●	●
Red-eyed Vireo	0.59 $\pm$ 0.13	48.28	●	●
Red-bellied Woodpecker†	0.48 $\pm$ 0.13	37.93	●	●
Acadian Flycatcher†	0.45 $\pm$ 0.14	31.03	●	●
Carolina Wren†	0.34 $\pm$ 0.10	31.03	●	●
Northern Cardinal	0.31 $\pm$ 0.11	24.14	●	●
American Crow	0.24 $\pm$ 0.12	17.24	●	●
Common Yellowthroat	0.24 $\pm$ 0.13	13.79	●	●
White-eyed Vireo†	0.24 $\pm$ 0.08	24.14	●	●
Mourning Dove	0.21 $\pm$ 0.08	20.69	●	●
Ovenbird	0.21 $\pm$ 0.09	17.24	●	●
Scarlet Tanager	0.21 $\pm$ 0.09	17.24	●	●
Blue-gray Gnatcatcher	0.17 $\pm$ 0.07	17.24	●	●
Eastern Bluebird	0.17 $\pm$ 0.10	10.34	●	●
Blue Grosbeak†	0.14 $\pm$ 0.08	10.34		●
Northern Bobwhite*	0.14 $\pm$ 0.07	13.79	●	●
Blue Jay	0.10 $\pm$ 0.06	10.34	●	●
Carolina Chickadee†	0.10 $\pm$ 0.06	10.34	●	●
Eastern Wood-Pewee*	0.10 $\pm$ 0.06	10.34	●	●
Field Sparrow*	0.10 $\pm$ 0.06	10.34	●	●
Pileated Woodpecker†	0.10 $\pm$ 0.08	6.90	●	●
Yellow-billed Cuckoo*	0.10 $\pm$ 0.06	10.34	●	●
Chipping Sparrow	0.07 $\pm$ 0.05	6.90	●	●
Northern Parula†	0.07 $\pm$ 0.05	6.90		●
Pine Warbler†	0.07 $\pm$ 0.05	6.90	●	●
Prairie Warbler*	0.07 $\pm$ 0.05	6.90		●
Red-headed Woodpecker*	0.07 $\pm$ 0.05	6.90	●	●
Wild Turkey	0.07 $\pm$ 0.05	6.90	●	●
Wood Thrush*	0.07 $\pm$ 0.05	6.90	●	●
American Robin	0.03 $\pm$ 0.03	3.45	●	●
Black Vulture	0.03 $\pm$ 0.03	3.45		●
Blue-headed Vireo	0.03 $\pm$ 0.03	3.45		●
Downy Woodpecker†	0.03 $\pm$ 0.03	3.45	●	●
Eastern Phoebe	0.03 $\pm$ 0.03	3.45		●
Great Crested Flycatcher	0.03 $\pm$ 0.03	3.45	●	●



**Table 15.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence from 2010-2011 at Malvern Hill, Richmond NBP.

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected	
			2010	2011
Northern Mockingbird	0.03 $\pm$ 0.03	3.45		●
Orchard Oriole†	0.03 $\pm$ 0.03	3.45		●
Red-shouldered Hawk†	0.03 $\pm$ 0.03	3.45	●	●
Red-tailed Hawk	0.03 $\pm$ 0.03	3.45	○	●
Yellow-breasted Chat	0.03 $\pm$ 0.03	3.45		●
Yellow-throated Vireo†	0.03 $\pm$ 0.03	3.45	●	●
American Goldfinch	-	-	○	○
Bald Eagle	-	-	○	
Barn Swallow	-	-		○
Belted Kingfisher	-	-	●	
Brown Thrasher*	-	-	●	
Brown-headed Cowbird	-	-	●	○
Canada Goose	-	-	●	○
Chimney Swift*	-	-	●	○
Common Grackle	-	-	○	○
Eastern Meadowlark*	-	-		○
European Starling <sup>1</sup>	-	-	●	
Gray Catbird	-	-	●	
Great Blue Heron	-	-	●	○
Hairy Woodpecker	-	-	●	
Hooded Warbler†	-	-	●	
Kentucky Warbler*	-	-	●	
Lesser Yellowlegs	-	-	●	
Louisiana Waterthrush	-	-	●	
Mallard	-	-	●	
Northern Flicker*	-	-	●	
Osprey	-	-	●	
Purple Martin†	-	-		○
Red-winged Blackbird	-	-	●	○
Ruby-throated Hummingbird	-	-	○	
Summer Tanager†	-	-	●	
Tree Swallow	-	-		○
Turkey Vulture	-	-	●	○
White-breasted Nuthatch	-	-	●	
Wood Duck	-	-	●	○
Yellow-throated Warbler	-	-	●	

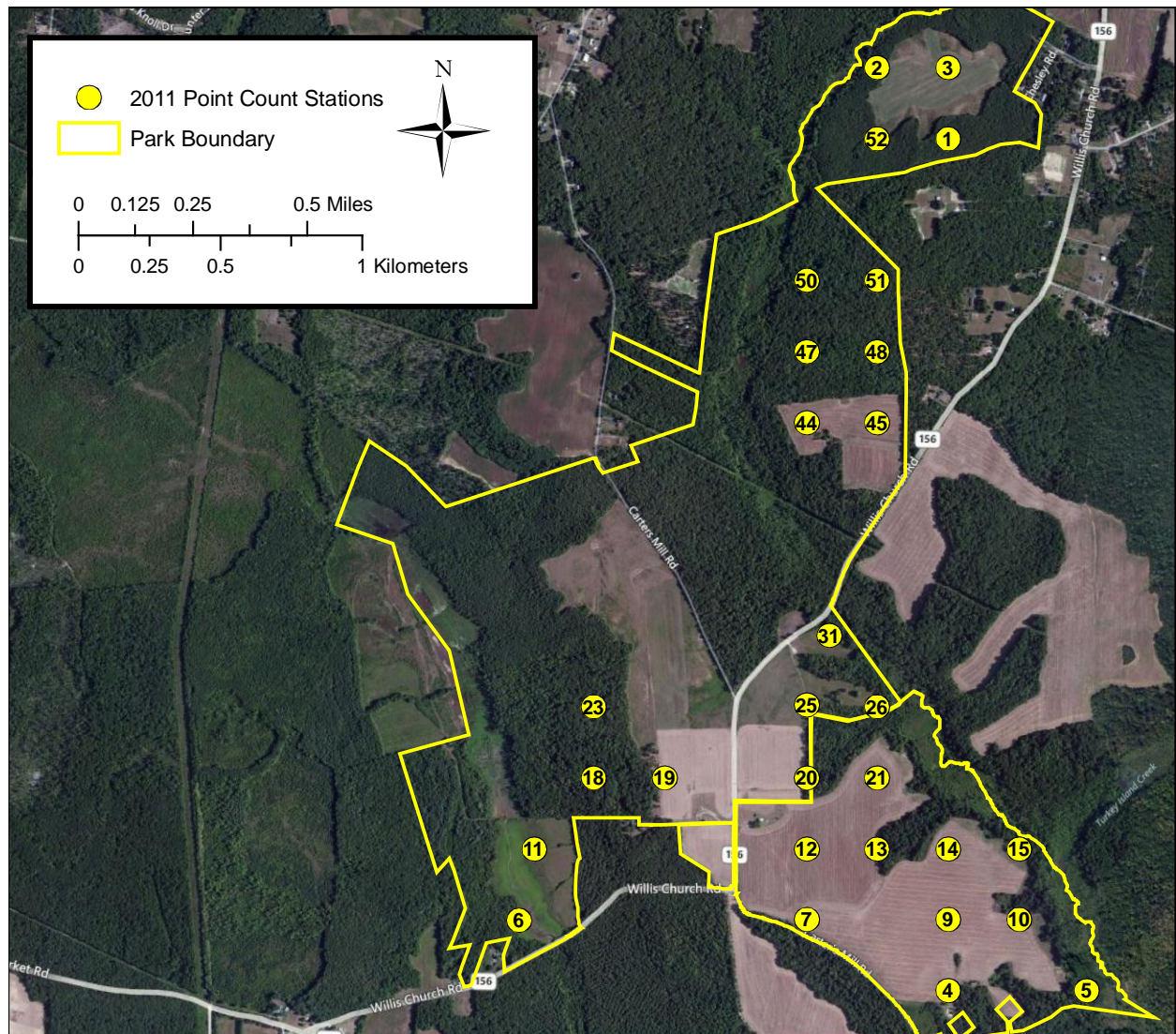
\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, <sup>1</sup>Exotic species



**Table 16.** Avian forest guild summary and Bird Community Index (BCI) score for 2010 and 2011 at Malvern Hill, Richmond NBP. Percents indicate the average percent guild membership at monitoring locations. Total BCI scores range from 0-1 with 1 having the highest integrity. Ranks are derived from O'Connell et al. (2003).

		2010 (n=22)		2011 (n=15)	
	Guild	Percent	Rank	Percent	Rank
Structural	Forest Interior	30.73	Naturalistic	25.63	Largely Intact
	Pine Associated	0.58	Moderately Disturbed	2.08	Largely Intact
	Urban/Suburban	40.61	Largely Intact	27.83	Largely Intact
Functional	Bark Prober	23.58	Naturalistic	25.16	Naturalistic
	Ground Forager	6.70	Largely Intact	6.26	Largely Intact
	Upper Canopy Forager	15.99	Largely Intact	24.99	Naturalistic
Compositional	Nest Predator/Brood Parasite	24.89	Humanistic	15.13	Largely Intact
	Single Brooded	44.28	Largely Intact	47.35	Naturalistic
	Exotic	5.26	Moderately Disturbed	0.00	Naturalistic
Total BCI Score		0.69	Largely Intact	0.86	Naturalistic





**Figure 11.** Bird monitoring stations surveyed at Malvern Hill, Richmond NBP in 2011.



# Valley Forge National Historical Park

Northeast Region  
Inventory & Monitoring Program

National Park Service  
U.S. Department of the Interior



## Mid-Atlantic Network

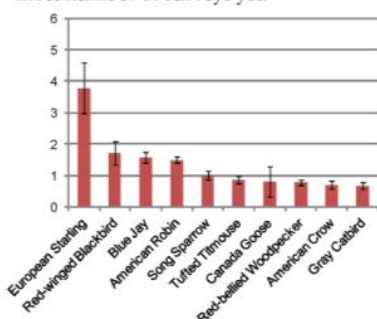
## Breeding Bird Resource Brief



Baltimore Oriole

### Valley Forge National Historical Park 2011 Status & Trends

A total of 74 stations were surveyed at Valley Forge NHP during the 2011 breeding bird monitoring program, including 36 stations in forested habitats and 38 stations in grassland habitats. Thirteen volunteer birders from the local birding community conducted an average of 3.39 surveys per station producing a total of 251 surveys for the season, the most number of surveys yet!



The 10 most commonly detected bird species at Valley Forge NHP in 2011 and their associated relative abundance (average birds/station). Error bars indicate standard error, a measure of variation.

Between May and July, 3,910 birds of 76 species were detected throughout the park. Several species were detected this year that were not in previous monitoring years including the Prairie Warbler, Double-crested Cormorant, Northern Rough-winged Swallow, Bobolink, Northern Parula, Louisiana Water-thrush, Grasshopper Sparrow, and Rose-breasted Grosbeak.

The European Starling was the most abundant species, averaging 3.78 birds per station, while the American Robin was the most prevalent species, occurring at 89.2% of stations surveyed.

Species of conservation concern, as defined by Partners in Flight (PIF), were well represented in the park, with volunteers detecting 24 species (see table on back right). PIF further distinguishes species of concern as “watchlist” species, which face immediate threats, or “stewardship” species, which are rep-

### Objectives

1. Determine annual changes and long-term trends in species composition and relative abundance.
2. Improve our understanding of relationships between breeding birds, habitats and park management.

resentative of avifaunal biomes that may or may not be in immediate danger.

Within the park, 15 watchlist species and 8 stewardship species were detected. Only 1 species of concern, the Red-bellied Woodpecker, was among the 10 most abundant species.

Avian guilds, or groups of species occupying similar ecological niches, can be utilized for assessing response to environmental changes and ecosystem stressors via bird community assessments, or “indices” (BCIs). Based on a BCI developed for the Piedmont/Coastal Plain region (O’Connell et al. 2003), forested stations surveyed this year



Tufted Titmouse

### Importance

In the densely populated Mid-Atlantic region, birds face numerous threats including urbanization, habitat loss, and fragmentation. National parks provide refuge from such threats with contiguous and protected tracts of habitat suitable for breeding birds. These parks host species of continental concern and other species that are declining throughout their range.

Birds are also excellent barometers of ecosystem health due to their high metabolism and prominent position in the food web. Detecting changes in bird populations may help alert park staff to ecological stressors such as invasive species, overbrowsing, detrimental park management practices, or climate change and help guide future management actions.

**Figure 12.** 2011 Resource Brief for Valley Forge NHP. A high resolution version may be downloaded from <http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>.



## Management Applications

- A total of 76 species were detected across the park including 24 species of concern.
- The Red-bellied Woodpecker, a species of concern, was among the 10 most common species in the park.
- The upper canopy forager guild increased in integrity from "moderately disturbed" to "largely intact", using a Bird Community Index (BCI).

## Long-term Monitoring

Between May and July of each year, volunteer birders conduct point counts at monitoring stations in forest and grassland habitats. Stations in forested areas are located within 125 m of forest vegetation monitoring plots enabling park staff to associate long-term trends in vegetation with avian population trends.

During each 10-minute count, the volunteer records environmental

conditions, how the bird was detected (visually or aurally), and the distance and minute of first detection.

Each site is visited at least once, but volunteers are encouraged to make multiple visits in a season. Multiple visits are especially important for obtaining accurate density estimates as information on variability due to observers, weather, etc. can be accounted for.

## Status & Trends Continued...

received the second highest ranking of "largely intact" which is consistent with the 2010 ranking for the park. All guild ranks remained consistent with last year's rankings with the exception of the upper canopy foragers which increased from "moderately disturbed" to "largely intact."

### References:

O'Connell, et al. 2003. A bird community index for the Mid-Atlantic Piedmont and Coastal Plain. Final Report to the USGS - Patuxent Wildlife Research Center. Report No. 2003-02.

### Photographs by:

Baltimore Oriole: Jim Schmidt  
Tufted Titmouse: Bill Thompson

		2010		2011	
Guild		Percent	Rank	Percent	Rank
Structural	Forest Interior	23.21	Largely Intact	23.27	Largely Intact
	Pine Associated	0.00	Humanistic	0.00	Humanistic
	Urban/Suburban	51.55	Moderately Disturbed	47.76	Moderately Disturbed
Functional	Bark Prober	20.57	Naturalistic	20.18	Naturalistic
	Ground Forager	0.47	Moderately Disturbed	0.57	Moderately Disturbed
	Upper Canopy Forager	11.52	Moderately Disturbed	15.31	Largely Intact
Compositional	Nest Predator/Brood Parasite	20.70	Moderately Disturbed	16.79	Moderately Disturbed
	Single Brooded	38.44	Largely Intact	40.74	Largely Intact
	Exotic	0.35	Largely Intact	0.69	Largely Intact
Total BCI Score		0.61	Largely Intact	0.64	Largely Intact

Avian forest guild summary and Bird Community Index (BCI) score for 2010-2011. Percents indicate the average percent guild membership at monitoring locations across the park. Total BCI scores range from 0-1 with 1 having the highest integrity.

Species	Detections	% Occupied
<b>Watchlist Species</b>		
Baltimore Oriole	44	57.63
Black-billed Cuckoo	2	3.39
Brown Thrasher	4	5.08
Chimney Swift	4	5.08
Eastern Kingbird	34	33.90
Eastern Meadowlark	44	35.59
Eastern Towhee	25	35.59
Eastern Wood-Pewee	12	16.95
Field Sparrow	29	30.51
Grasshopper Sparrow	1	1.69
Northern Flicker	25	38.98
Prairie Warbler	3	1.69
Willow Flycatcher	4	5.08
Wood Thrush	21	23.73
Yellow-billed Cuckoo	1	1.69
<b>Stewardship Species</b>		
Carolina Chickadee	25	37.29
Carolina Wren	14	23.73
Downy Woodpecker	13	20.34
Indigo Bunting	18	28.81
Northern Parula	1	1.69
Orchard Oriole	33	23.73
Pileated Woodpecker	8	11.86
Red-bellied Woodpecker	47	55.93

Number of detections of Partners in Flight (PIF) watchlist and stewardship species and percent of stations they were detected at in Valley Forge NHP. Number of detections exclude flyovers and incidental encounters

## A Final Note

It is important to note that the data presented in this brief is preliminary as variability in the dataset has not yet been accounted for. For more information on this protocol, please see the full annual report accessible from the protocol website linked below.

Last but not least, we'd like to thank all our volunteers for walking off the beaten path in the summer heat to collect the data summarized in this brief.



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**Protocol Website:**  
More information and full annual reports may be found at  
<http://science.nature.nps.gov/im/units/midn/ProtocolBirds.cfm>

March 2012

Figure 12. 2011 Resource Brief for Valley Forge NHP (continued).



**Table 17.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence between 2009-2011 at Valley Forge NHP. Closed circles indicate species that were detected in a station while open circles indicate species that were only detected as flyovers or incidentals.

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected		
			2009	2010	2011
European Starling <sup>1</sup>	3.78 $\pm$ 0.81	36.49	●	●	●
Red-winged Blackbird	1.70 $\pm$ 0.37	44.59	●	●	●
Blue Jay	1.57 $\pm$ 0.18	77.03	●	●	●
American Robin	1.49 $\pm$ 0.10	89.19	●	●	●
Song Sparrow	1.00 $\pm$ 0.13	56.76	●	●	●
Tufted Titmouse	0.86 $\pm$ 0.10	63.51	●	●	●
Canada Goose	0.80 $\pm$ 0.48	6.76	●	●	●
Red-bellied Woodpecker†	0.78 $\pm$ 0.09	58.11	●	●	●
American Crow	0.70 $\pm$ 0.12	41.89	●	●	●
Gray Catbird	0.68 $\pm$ 0.10	47.30	●	●	●
Northern Mockingbird	0.68 $\pm$ 0.10	43.24	●	●	●
Baltimore Oriole*	0.68 $\pm$ 0.10	52.70	●	●	●
Eastern Meadowlark*	0.65 $\pm$ 0.12	31.08	●	●	●
Red-eyed Vireo	0.55 $\pm$ 0.08	41.89	●	●	●
Northern Cardinal	0.55 $\pm$ 0.08	41.89	●	●	●
Carolina Chickadee†	0.54 $\pm$ 0.09	43.24	●	●	●
American Goldfinch	0.54 $\pm$ 0.09	39.19	●	●	●
Eastern Kingbird*	0.49 $\pm$ 0.11	28.38	●	●	●
Wood Thrush*	0.49 $\pm$ 0.09	33.78	●	●	●
Orchard Oriole†	0.46 $\pm$ 0.13	20.27	●	●	●
Common Yellowthroat	0.41 $\pm$ 0.09	28.38	●	●	●
Field Sparrow*	0.41 $\pm$ 0.09	24.32	●	●	●
Mourning Dove	0.38 $\pm$ 0.08	25.68	●	●	●
Eastern Wood-Pewee*	0.38 $\pm$ 0.08	28.38	●	●	●
Great Crested Flycatcher	0.38 $\pm$ 0.07	33.78	●	●	●
White-breasted Nuthatch	0.38 $\pm$ 0.07	31.08	●	●	●
Chipping Sparrow	0.38 $\pm$ 0.08	28.38	●	●	●
Northern Flicker*	0.36 $\pm$ 0.07	33.78	●	●	●
Eastern Towhee*	0.35 $\pm$ 0.07	29.73	●	●	●
Common Grackle	0.26 $\pm$ 0.10	13.51	●	●	●
Downy Woodpecker†	0.24 $\pm$ 0.05	22.97	●	●	●
Indigo Bunting†	0.24 $\pm$ 0.05	22.97	●	●	●
Tree Swallow	0.23 $\pm$ 0.07	13.51	●	●	●
Carolina Wren†	0.22 $\pm$ 0.05	21.62	●	●	●
Scarlet Tanager	0.22 $\pm$ 0.05	20.27	●	●	●
Eastern Bluebird	0.20 $\pm$ 0.06	17.57	●	●	●
Cedar Waxwing	0.18 $\pm$ 0.06	13.51		●	●



**Table 17.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence between 2009-2011 at Valley Forge NHP (continued).

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	Detected		
			2009	2010	2011
Turkey Vulture	0.16 $\pm$ 0.06	10.81	●	●	●
Barn Swallow	0.15 $\pm$ 0.07	9.46	●	●	●
American Kestrel	0.14 $\pm$ 0.05	10.81	●	●	●
Pileated Woodpecker†	0.14 $\pm$ 0.05	10.81		●	●
Warbling Vireo	0.14 $\pm$ 0.04	13.51	●	●	●
Wood Duck	0.12 $\pm$ 0.12	1.35		○	●
House Wren	0.12 $\pm$ 0.04	12.16	●	●	●
Brown-headed Cowbird	0.12 $\pm$ 0.04	10.81	●	●	●
Mallard	0.11 $\pm$ 0.08	2.70	●	●	●
Yellow Warbler	0.11 $\pm$ 0.04	10.81	●	●	●
House Finch	0.09 $\pm$ 0.07	4.05	●	●	●
Hairy Woodpecker	0.07 $\pm$ 0.03	6.76	●	●	●
Black Vulture	0.05 $\pm$ 0.03	4.05	●	●	●
Chimney Swift*	0.05 $\pm$ 0.03	4.05	●	●	●
Willow Flycatcher*	0.05 $\pm$ 0.03	4.05	●	●	●
Eastern Phoebe	0.05 $\pm$ 0.03	5.41	●	●	●
Brown Thrasher*	0.05 $\pm$ 0.03	4.05	●	●	●
Red-tailed Hawk	0.04 $\pm$ 0.03	2.70	●	●	●
Prairie Warbler*	0.04 $\pm$ 0.04	1.35			●
Ovenbird	0.04 $\pm$ 0.03	2.70	●	●	●
Double-crested Cormorant	0.03 $\pm$ 0.03	1.35			●
Black-billed Cuckoo*	0.03 $\pm$ 0.02	2.70		○	●
Yellow-billed Cuckoo*	0.03 $\pm$ 0.02	2.70		●	●
Northern Rough-winged Swallow	0.03 $\pm$ 0.03	1.35			●
Bobolink	0.03 $\pm$ 0.02	2.70			●
Belted Kingfisher	0.01 $\pm$ 0.01	1.35	●	●	●
Blue-gray Gnatcatcher	0.01 $\pm$ 0.01	1.35	●	●	●
Northern Parula†	0.01 $\pm$ 0.01	1.35			●
American Redstart	0.01 $\pm$ 0.01	1.35		●	●
Louisiana Waterthrush	0.01 $\pm$ 0.01	1.35			●
Grasshopper Sparrow*	0.01 $\pm$ 0.01	1.35			●
Rose-breasted Grosbeak	0.01 $\pm$ 0.01	1.35			●
Mute Swan	-	-			○
Great Blue Heron	-	-	●	●	○
Green Heron	-	-			○
Cooper's Hawk	-	-	○		○
Broad-winged Hawk*	-	-			○



**Table 17.** Summary statistics for point count surveys conducted in 2011 and patterns of occurrence between 2009-2011 at Valley Forge NHP (continued).

Species	Abundance ( $\bar{x} \pm SE$ )	Occurrence (% stations)	2009	Detected 2010	2011
Rock Pigeon <sup>1</sup>	-	-		○	○
Bank Swallow	-	-		●	○
Sharp-shinned Hawk	-	-		○	
American Coot	-	-		●	
Killdeer	-	-		●	
Eastern Screech-Owl	-	-		●	
Acadian Flycatcher†	-	-		●	
White-eyed Vireo†	-	-	●	●	
Fish Crow	-	-		●	
Veery	-	-	●	●	
Blue-winged Warbler*	-	-	●	●	

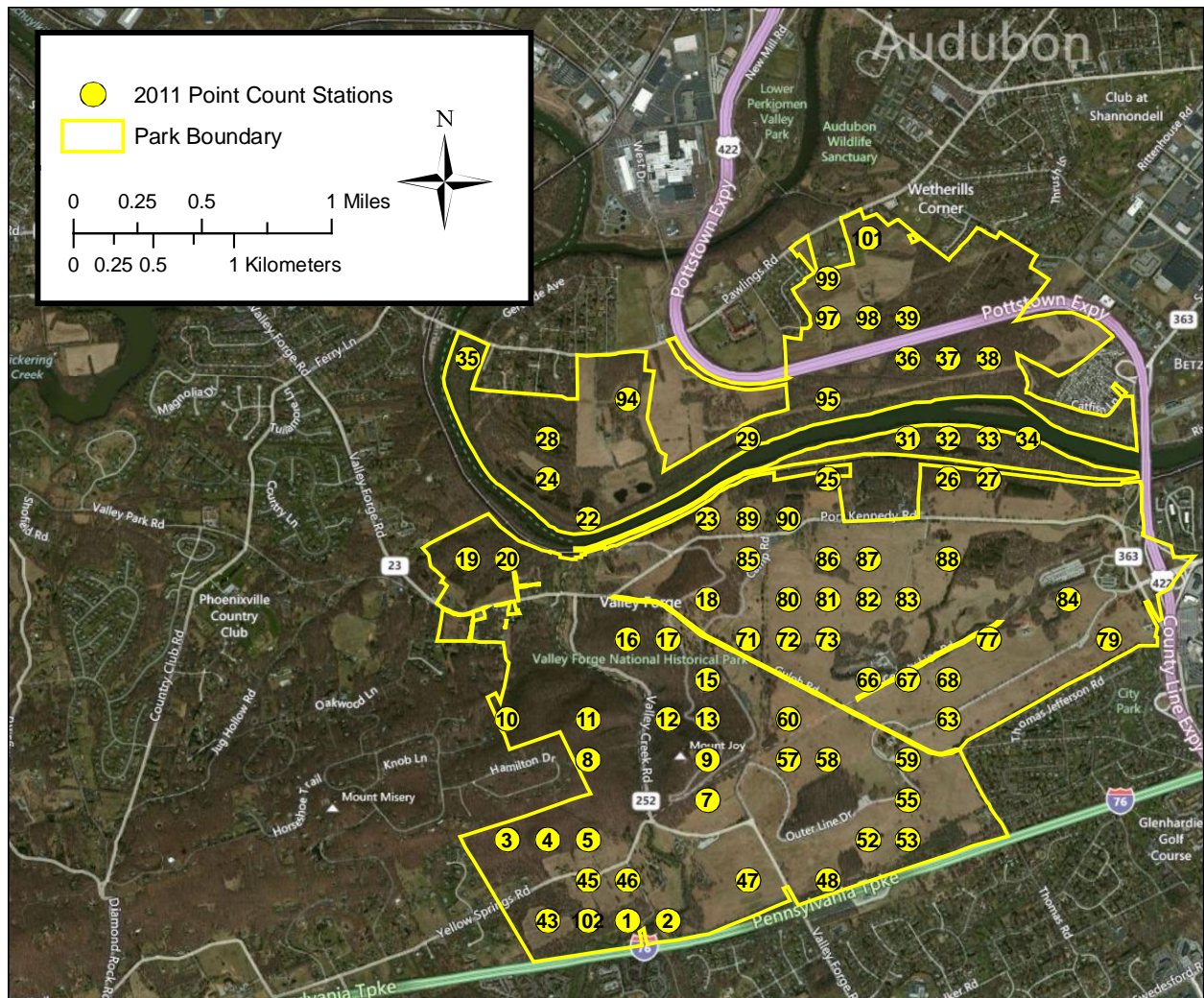
\*Partners in Flight Watchlist species, †Partners in Flight Stewardship species, <sup>1</sup>Exotic species



**Table 18.** Avian forest guild summary and Bird Community Index (BCI) score for 2009 - 2011 at Valley Forge NHP. Percents indicate the average percent guild membership at monitoring locations. Total BCI scores range from 0-1 with 1 having the highest integrity. Ranks are derived from O'Connell et al. (2003).

		2009 (n=38)		2010 (n=47)		2011 (n=89)	
Guild		Percent	Rank	Percent	Rank	Percent	Rank
Structural	Forest Interior	23.00	Largely Intact	23.21	Largely Intact	23.27	Largely Intact
	Pine Associated	0.00	Humanistic	0.00	Humanistic	0.00	Humanistic
	Urban/Suburban	50.27	Moderately Disturbed	51.55	Moderately Disturbed	47.76	Moderately Disturbed
Functional	Bark Prober	17.12	Largely Intact	20.57	Naturalistic	20.18	Naturalistic
	Ground Forager	0.36	Moderately Disturbed	0.47	Moderately Disturbed	0.57	Moderately Disturbed
	Upper Canopy Forager	15.99	Largely Intact	11.52	Moderately Disturbed	15.31	Largely Intact
Compositional	Nest Predator/Brood Parasite	23.24	Humanistic	20.70	Moderately Disturbed	16.79	Moderately Disturbed
	Single Brooded	39.46	Largely Intact	38.44	Largely Intact	40.74	Largely Intact
	Exotic	0.00	Naturalistic	0.35	Largely Intact	0.69	Largely Intact
Total BCI Score		0.61	Largely Intact	0.61	Largely Intact	0.64	Largely Intact





**Figure 13.** Bird monitoring stations surveyed at Valley Forge NHP in 2011.



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## Appendix A. Forested guild assignments

Several guild categories were considered in the development of the forested guild BCI and ultimately, only a subset of these guilds was found to be responsive to forest structure change (O’Connell et al. 2003). For that reason, some of the guild categories below do not cover the guild a species belongs to. For example, Acadian Flycatchers are aerial salliers under the functional guild category. As this guild is not part of the final structure of the BCI, this space is left blank.

Species	Guild		
	Structural	Functional	Compositional
Acadian Flycatcher	forest interior		single brood
American Crow	urban/suburban		nest predator/brood parasite
American Goldfinch	urban/suburban		
American Redstart	forest interior		single brood
American Robin	urban/suburban		
Bachmans Sparrow	pine associated		
Baltimore Oriole		upper canopy forager	single brood
Black-and-White Warbler	forest interior	bark prober	single brood
Black-billed Cuckoo			single brood
Black-capped Chickadee		bark prober	single brood
Black-throated Green Warbler		upper canopy forager	single brood
Blue Jay	urban/suburban		nest predator/brood parasite
Blue-gray Gnatcatcher		upper canopy forager	
Boat-tailed Grackle			nest predator/brood parasite
Bobolink			single brood
Brown Thrasher			single brood
Brown-headed Nuthatch	pine associated		single brood
Carolina Chickadee		bark prober	single brood
Carolina Wren	urban/suburban		
Cedar Waxwing	urban/suburban		
Cerulean Warbler	forest interior	upper canopy forager	single brood
Chimney Swift	urban/suburban		single brood
Chipping Sparrow	urban/suburban		
Common Grackle	urban/suburban		nest predator/brood parasite; single brood
Downy Woodpecker	urban/suburban	bark prober	
Eastern Kingbird			single brood
Eastern Towhee	forest interior		
Eastern Wood-Pewee	forest interior		single brood
Eurasian Collared Dove	urban/suburban		exotic
European Starling	urban/suburban		nest predator/brood parasite; exotic
Fish Crow			nest predator/brood parasite; single brood
Gray Catbird	urban/suburban		
Great Crested Flycatcher			single brood
Hairy Woodpecker	forest interior	bark prober	single brood
Hooded Warbler	forest interior		



Species	Guild		
	Structural	Functional	Compositional
House Finch	urban/suburban		exotic
House Sparrow	urban/suburban		nest predator/brood parasite; exotic
Kentucky Warbler	forest interior	ground forager	single brood
Loggerhead Shrike			nest predator/brood parasite
Louisiana Waterthrush	forest interior	ground forager	single brood
Mourning Dove	urban/suburban		
Northern Cardinal	urban/suburban		
Northern Flicker		ground forager	single brood
Northern Mockingbird	urban/suburban		
Northern Parula	forest interior	upper canopy forager	single brood
Northern Rough-winged Swallow			single brood
Orchard Oriole			single brood
Ovenbird	forest interior	ground forager	single brood
Pileated Woodpecker	forest interior	bark prober	single brood
Pine Warbler	pine associated	bark prober	
Prairie Warbler			single brood
Purple Martin	urban/suburban		single brood
Red-bellied Woodpecker	urban/suburban		nest predator/brood parasite
Red-cockaded Woodpecker	pine associated	bark prober	single brood
Red-eyed Vireo		upper canopy forager	single brood
Red-headed Woodpecker			nest predator/brood parasite
Rock Dove/Pigeon	urban/suburban		exotic
Rose-Breasted Grosbeak	forest interior	upper canopy forager	
Ruby-throated Hummingbird	urban/suburban		
Scarlet Tanager	forest interior	upper canopy forager	single brood
Song Sparrow	urban/suburban		
Summer Tanager		upper canopy forager	single brood
Swainsons Warbler	forest interior	ground forager	single brood
Tree Swallow			single brood
Tufted Titmouse		bark prober	
Veery	forest interior		single brood
Warbling Vireo		upper canopy forager	
White-breasted Nuthatch	forest interior	bark prober	single brood
Willow Flycatcher			single brood
Wood Thrush	forest interior		single brood
Worm-eating Warbler	forest interior		single brood
Yellow Warbler			single brood
Yellow-billed Cuckoo		upper canopy forager	single brood
Yellow-throated Vireo	forest interior	upper canopy forager	single brood
Yellow-throated Warbler			single brood



## **Guild Descriptions**

Individual guilds are broadly categorized as “specialist” or “generalist” based on their relationship to specific elements of ecosystem structure, function, and composition (O’Connell 2003). A specialist can be a species with a narrow range of habitat tolerances, while a generalist can be a species with a wide range of habitat tolerances. For our purposes, specialist guilds may be thought of as “guilds indicative of a high-integrity condition” while generalist guilds are “guilds indicative of a low-integrity condition.”

### ***Structural Guilds***

Species guilds based on nesting and/or foraging habitat requirements

#### Forest Interior (Specialist)

This guild includes species that require large blocks of interior forest. Few to none of the species in this guild are typically supported in small forest fragments (<10ha; Robbins et al. 1989, Freemark and Collins 1992) and numbers typically decline with increasing human disturbance (O’Connell 2003, Glennon and Porter 2005).

Examples include the Ovenbird, Louisiana Waterthrush, Yellow-throated Warbler, and Eastern Wood Peewee.

#### Pine Associated (Specialist)

This guild is comprised of species that require pine forest or plantations for foraging and nesting. The proportion of pine associated guild species is typically low compared to other species, but is positively correlated with habitat quality.

Examples include the Pine Warbler, Brown-headed Nuthatch, and Red-Cockaded Woodpecker.

#### Urban/Suburban (Generalist)

These are species that typically occur in human dominated environments. They nest and forage in a wide range of habitats and many prefer edges. Exotic species fall in this guild and hence large proportions of these species are indicative of poor-quality habitat.

Northern Mockingbird, House Finch, Gray Catbird, and Song Sparrow are all examples of Urban/Suburban guild species.

### ***Functional Guilds***

Species guilds based on foraging habit

#### Bark Prober (Specialist)

Insectivorous species that primarily forage via bark probing fall in this guild. They require standing snags, large diameter coarse woody debris (CWD), and/or mature trees with deeply furrowed or flaking bark which provide substrates that support abundant insect populations. Increasing proportions of these guilds indicate higher forest integrity.

Examples include the woodpeckers, nuthatches, and chickadees.



### Upper Canopy Forager (Specialist)

This guild includes species that forage high in the forest canopy. These species are typically restricted to mature forests and many are considered forest interior obligates. The majority of the species in this guild are insectivorous warblers. Like the Forest Interior guild the proportion of species in this guild increases with forest integrity.

Examples of species in this guild are the Baltimore Oriole, Black-throated Green Warbler, Blue-gray Gnatcatcher, and Cerulean Warbler.

### Ground Forager (Specialist)

Species that primarily forage by gleaning insects from the ground fall into this guild. They include specialized insectivores that pick insects from the leaf litter or directly from the ground. Like species in the Pine Associated guild, numbers of these species are low and hence detections are difficult to rare, but higher proportions of these species are indicative of good forest integrity.

The Kentucky Warbler, Louisiana Waterthrush, Northern Flicker, and Swainsons Warbler are examples of species form this guild.

### ***Compositional Guilds***

Species guilds based on factors that are not functional or structural (e.g. interspecific dynamics, breeding phenology)

### Single-brooded (Specialist)

This guild is comprised of species that typically raise only one brood per breeding season. Many single-brooded species are restricted to interior forest habitat, and are absent from smaller forest fragments due to increased competition and higher rates of predation and nest parasitism associated with edge habitats (Freemark and Collins 1992). Hence, proportional species richness for this guild increases with forest integrity.

Species in this guild include Red-eyed Vireos, Tree Swallows, Yellow-billed Cuckoos, and Wood Thrush.

### Nest Predator / Brood Parasite (Generalist)

This guild includes species that are nest predators or brood parasites. Nest predators and brood parasites have been shown to negatively affect the distribution, abundance, and nest success of other bird species, particularly neotropical migrants (Wilcove 1985, Robinson et al. 1993), and these effects increase significantly in fragmented and edge habitats (Robinson et al. 1995). Hence high proportions of species in this guild are indicative of poor forest integrity.

Many of the Corvids fall into this guild along with European Starlings, Red-bellied Woodpeckers, and Red-headed Woodpeckers.

### Exotic (Generalist)

This guild is comprised of species that are not native to the study region. Typically edge-loving, generalists, species in this guild are indicative of poor forest integrity. Additionally, species in this guild often disrupt natural communities and compete with native species for nesting sites.

Species such as the House Finch, Rock Dove, and European Starling fall in this guild.



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